MODEL AIRPLANE NEWS

FLY A HELI WITHOUT CRASHING

THE WORLD'S PREMIER R/C MODELING MAGAZINE

48120

GIANT-SCALE *Masterpieces*

page 28

HANGAR 9
¼ SCALE
CAP 232
ARF

Reviews

ROBO **Shuttle Challenge**
FAIL-SAFE HELI TRAINER

REAT PLANES
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Member Audit Bureau of Circulations

PRINTED IN THE USA

MODEL AIRPLANE NEWS

JUNE 1999 • VOLUME 127, NUMBER 6


p. 28

ON THE COVER: main image—the Hangar 9 CAP 232 is an ARF that delivers (photo by Gerry Yarrish); inset—John Dalton's 140-inch-span Douglas DC-3 was just one of the impressive models at the QSAA Giant-Scale Fly-In (photo by Jerry Nelson); master modeler Nick Ziroli has had even more fun at the flying field since he added power and R/C to these foamie Robart gliders; he shows you how on page 74.

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Columns

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Supporting our supporters

DO YOU PAY attention to which companies sponsor the events you attend, or the ones you read about and would like to attend? Have you ever thought about what these events—and our hobby in general—would be like, if not for the large amounts of money and merchandise that many companies give to event organizers? We really should think about these things and be proactive in maintaining this goodwill.

And why, you might ask, should we care? Well, if you attend sponsored events, it's clear. Events we've covered recently, such as Top Gun, Scale Masters, USRA Champs and the Arizona Jet Rally, are ideal venues for participants to do their thing, compete for prizes and display their beautiful models. Sponsorship assists the contest directors with such things as providing facilities and prizes and handling expenses, all of which are necessary for the success of these large events.

You say you're not interested in competition? OK; I've never competed at Top Gun either, but I've benefited from it, as have you. In addition to the enjoyment of seeing and reading about the great models, events such as Top Gun present our hobby to large crowds of spectators, many of whom are not modelers, but who may *become* modelers. These big events not only provide us with new entrants to our modeling community, but this exposure also demonstrates to the general public that what we do is an adult hobby that's worthy of consideration. These events represent the very "face" of our hobby to the non-modeling public, and a good "face" helps when clubs approach landowners for flying sites, ask for donations and a whole host of other things.

It's also the case that many of the products and methodologies we use are generated by the guys who are competing, as they're always looking for better ways of doing things to improve their chances. The spinoffs of these events cannot be overstated, in my opinion, and these events simply wouldn't exist without the heavy sponsorship that exists.

Nor is sponsorship restricted to large competitions; all over the country, events of all kinds benefit from sponsorship. Raffle prizes and awards are offered at most meets, and these prizes are often the result of sponsorship.

Who are these sponsors? Surprisingly, they are sometimes difficult to identify. The manufacturers who lay out large sums of money are often not very visible. When we present coverage of an event, we try to list the sponsors; but since we're at the mercy of the event organizers for this information, our list often isn't as complete as we would like it to be. When you read a list of sponsors, you'll find a lot of companies; some of them are smaller outfits that do what they can to provide prizes and such. Often, they are "specialty" companies; you'll see jet manufacturers at jet events, electric power manufacturers at electrics events, etc. Larger scale philanthropy by some of the larger companies is a regular occurrence: Pacer Technologies, Airtronics, JR, Hitec, Futaba, Robart, Hobbico, Horizon Hobby Distributors and model magazines (including us)—and others—do considerable sponsoring during the year.

So next time you're flying at an event, whether it's a local fun fly or at Top Gun, take some time to look over the sponsor list. If possible, thank those sponsors for supporting the hobby that we all love. If you're an event organizer, consider sponsorship when you make your purchasing decisions; it's the glue that holds our community together, and it's easy not to think about it until it's gone.

Top left: Nick Rivaldo's B-24D Liberator comes in for a landing at the QSAA's annual event; top right: another QSAA beauty was this Spirit of 76 Waco UPF-7 built by Don Thorson. Above: William Lewis and his de Havilland DH-1. The model won the QSAA Best Static Display award.

QSAA AND THE HANGAR 9 CAP 232

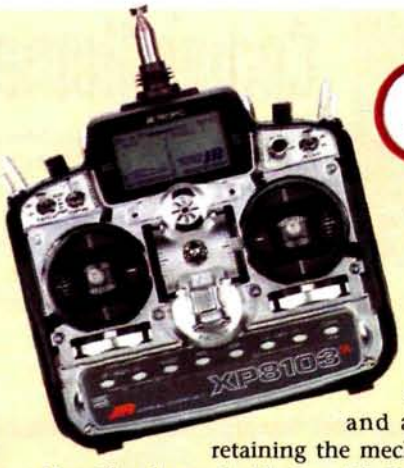
Speaking of events, the QSAA has been holding its annual event for a long time. Each year, like a bunch of locusts swarming to an oasis, QSAA pilots from around the world descend on a dry lakebed in Nevada to fly big airplanes. Jerry Nelson was there for us and shot some great photos of some of these models, and they are gorgeous.

Every once in a while, a product comes along that redefines the genre. This is the case with the new Hangar 9 CAP 232. It's an ARF, and though ARFS are popular, they don't tend to generate excitement. The Hangar 9 CAP is different in that regard, as it's a perfectly built, IMAA-legal aerobatic plane that ... well, just turns people's cranks. It's sweet flying, good looking, and ... heck, I'm jealous as can be that Gerry has one and I don't. He'll fill you in on the details of this new ARF. +

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

AIR SCOOP

BY CHRIS CHIANELLI



JR COMPUTER UPDATES

JR has improved its 8-channel XP8103 computer radio system to include its new 3+1 Digital Trims. This new arrangement uses digital trim switches on the elevator, rudder and aileron channels while retaining the mechanical trim lever on the throttle channel. Along with these trim switches come several other features such as Auto Trim Memory, which automatically stores trim position whenever a digital switch is used. Modelers will also be able to assign from 1 to 10 trim steps per "click" of a digital trim switch. Another benefit of the new digital trims is Audible Trim Position Tones. Using tones of varying pitch and frequency, the digital trim switches allow a modeler to know how much trim he is using—and in which direction—without having to take his eyes off the model. Also included are four types of CCPM mixing for helicopter pilots.

Pictured here with the great smile of Horizon Hobby's Deb Webber is JR's new XP652. Based on JR's popular XP642 radio, the XP652 adds a few new twists to its predecessor, such as dual modulation (FM and PCM), dual model software (airplane and helicopter), exponential rates, endpoint adjustment and preprogrammed mixes. Besides bringing the available model memory up to five models, the XP652 offers helicopter pilots 120-degree, three-servo CCPM mixing. Heli pilots will also like the new Stunt Trim feature that allows them to store separate aileron, elevator and rudder trims that are activated when the stunt mode is switched on. Topping it all off are new, supersmooth gimbals with adjustable tension and stick length that give the XP652 the feel of a much more expensive 7- or 8-channel radio. Rumor has it that the XP652 will be as fantastic a buy as the XP642 was.

Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511.

NEWS FLASH!

INNOVATIVE MODEL OF THE YEAR

Six international R/C modeling magazines have named Kyosho's T-33 electric ducted-fan Model of the Year. International event journalist Guy Revel presented the award trophy to Kyosho president Aki Suzuki at the recent Nuremberg Toy and Hobby Show. *Model Airplane News* congratulates Mr. Suzuki and Kyosho. We fully concur with the award; our experience with the T-33 was very rewarding.

MOST READY TO FLY

Global touts its new Ultimate .46 ARF as the *most* ready to fly a model can be and still be able to fit in a box. They go on to boast that it's "the most complete, all-balsa ARF ever offered." After hearing that statement, I certainly can't wait to see one!

Both wings are joined and covered with polyester; even the interplane struts are covered. The fiberglass cowl and molded wheel pants come painted, and the premounted cabane struts are easily adjustable. Specs: wingspan—43 inches; wing area—732 square inches; flying weight—5.75 pounds; wing loading—18.4 ounces per square foot; engine required—.46 2-stroke or .52 4-stroke; radio required—4-channel with four servos.

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

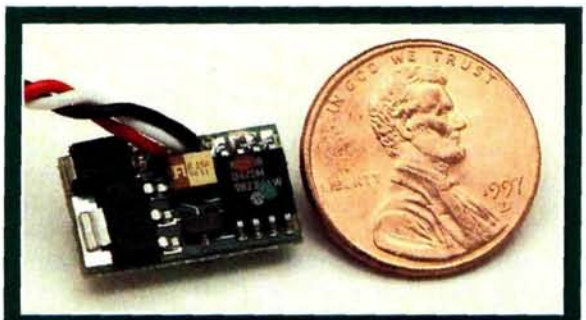
Jenny Comes Home

Proctor Enterprises announced the re-release of its beautiful, 1/6-scale Curtiss Jenny after a painful 5-year absence. This exquisite, museum-scale model spans 87 inches and features an exact-scale OX-5 engine, functional turnbuckles, all fittings and stainless-steel rigging and control cables. Proctor's Jenny is a proven veteran of countless Scale Masters and Top Gun competitions. I welcome back the gorgeous Jenny; a lot of us missed her terribly.

Proctor Enterprises, 25450 N.E. Eiler Rd., Aurora, OR 97002; (503) 678-1300.

The latest words from Budapest are "bigger is better," and if any company is well equipped to make a reliable, big-bore single, that company is Moki. Here are its new engines that are sure to be very popular with the giant-scale crowd: the 1.35 (foreground) and the 2.10XL. The 1.35 replaces the 1.20; it puts out 3.45hp at 9,800rpm. The 2.10 replaces the 1.85 and puts out an awesome 4.95hp at a very usable 8,800rpm. Both of these powerhouses feature Moki's proven fuel-metering system in the carburetor. Reports are that the 1.35 turns a 16x10 at 9,300rpm, and the 2.10 turns a 20x10 at 7,500rpm and gives forth an impressive 25 pounds of thrust! Now, *that's* serious motivation.

Gerard Enterprises Inc., 13435 Rosewell Dr., Brookfield, WI 53005; (414) 784-4510; fax (414) 784-4520.



THE POWERFUL PIXIE

This minuscule, microprocessor-controlled Pixie-Lite speed control handles up to 14 amps of continuous current—provided there is proper airflow. Amazing! This sub-micro digital controller features surface-mount construction; 0.00045 ohm resistance; high-rate (2800Hz) switching (PWM); low voltage (3.5V) cutoff; high-output BEC; low-torque, soft-start safety; power-on arming safety; auto motor cutoff with reset; and auto signal loss shutdown. The unit will handle 5 to 7 cells with 3 microservos, up to 10 cells with 2 microservos, or 18 cells (maximum) with BEC disabled.

Castle Creations, 1625 E. Drury Ln., Olathe, KS 66062; (913) 397-0813; email: pdelcast@idir.net.

Force 45

DIESEL OR GLOW

The AeroKrafters Force 45 is designed around the K&B ABC .40 for either glow or Davis Diesel conversion. According to the manufacturer, while the 5.5-pound model performs very well on glow power with an APC 10x6 prop, "performance is out of sight" with the K&B .40 fitted with a Davis Diesel head and spinning a 12x6 APC at 12,000 to 13,000rpm. The kit features carbon-reinforced and presheeted composite flying surfaces; laser-cut carbon fiber and a Kevlar-reinforced fuselage with interlocking parts and balsa, presheeted front and rear decks. AeroKrafters and Bob Davis worked together to equip the diesel version of this kit, which includes gasoline conversion, gas tank, Tygon tubing, soft motor mount and longer landing gear for the clearance needed by the larger prop sizes the diesel will turn. The kit also includes an aluminum spinner with K&B nut; machined-aluminum wheels; aluminum landing gear; fiberglass belly pan and cowl; pull/pull rudder system; Sullivan metal control horns; remote fuel-filler valve and tailwheel bracket. Three versions are available. AeroKrafters: (317) 865-0242.

THE MECOA LINE GROWS

Here are Mecoa's new .15 and .32 aircraft and .32 heli engines. All these engines feature true ABC piston-and-sleeve assemblies; twin ball-bearing-supported crankshafts, and forged connecting rods that are bronze-bushed at both ends The .32 size features twin needle-valve carburetors while the .15 sports an air-bleed type. Expansion chamber mufflers are supplied with the aircraft versions. Rumor has it that the prices are fantastic; call to confirm this.

Mecoa: (800) FLY MY RC (359-6972).

ALMOST READY TO COVER!

This is RadioCraft's beautiful Staudacher S-300D ARC, and yes; the inset photo shows how it comes to you almost ready for your favorite covering scheme. Kit features include a 97-percent-prebuilt, balsa and lite-ply fuselage; 100-percent-prebuilt wing panels and tail feathers; fiberglass cowl and wheel pants, and aluminum wing tube and landing gear. This giant-scale model meets all IMAC, IMAA and QSAA rules and requirements. Specs: wingspan—103 inches; wing area—1,950 square inches; length—97 inches; weight—23 to 25 pounds; engine required—70 to 100cc.

RadioCraft Industries Inc., 1843 E. Leland Cir., Mesa, AZ 85203; (602) 898-1463.

B I G - T I M E F U N

DYNAFLITE

GIANT Decathlon

Dynaflite's new Fun Scale Decathlon looks like the perfect model for getting into aerobatics. Bigger flies easier, I always say. Though this huge, 89-inch-wingspan kit is IMAA-legal, according to the manufacturer, it builds like any other sport model; the parts are just bigger. The kit features precision die-cut wooden parts; vacuum-formed windscreen, cowl and wheel pants; airfoil-shaped struts; 5-lamination, built-up tail section and heavy-duty aluminum landing gear. Specs: wingspan—89 inches; wing area—1,237 square inches; airfoil—Selig 8036; weight—16 to 18 pounds; wing loading—29.8 to 33.5 ounces per square foot; length—69 inches; engine required—1.08 to 1.8 2-stroke or 1.20 to 1.16 4-stroke, or 25 to 35cc ignition; radio required—4-channel with six servos (five of which must be high-torque with no less than 50 oz.-in.) and 1000mAh RX battery.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826; (800) 682-8948; fax (217) 398-0008.

AIRWAVES

Our readers write back

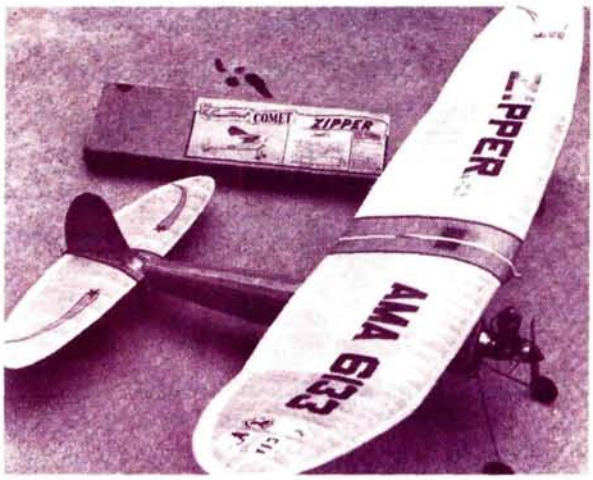
WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," MODEL AIRPLANE NEWS, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

IT'S A ZIPPER

In your March 1999 issue, I kindly take exception to a caption in your story, "From Modeler to Test Pilot" (pages 46-50). On page 48, the top center photo is captioned "Comet Clipper." I believe this to be the wrong name of the model. The model is a "Comet Zipper," by Carl Goldberg. The "Clipper" was a cabin model; the one shown is a pylon model. I'm sure that you will receive some other letters about this.

I see that the winners of the Jo Kotula contest (page 18) were from the Midwest, save one from Maryland. Within 3 hours of receiving my issue, I dispatched my entry at the post office. I was wondering if perhaps there was a mailing schedule that might favor the middle part of America. I don't wish to appear a sore loser, but it does make me wonder.

KEVORK FAGS
River-Vale, NJ



You're right that the caption misidentified Corky's beautiful Zipper as a Clipper. I suspect that 50 years of time caused Corky's memory to skip a beat. In fact, my guess is that he built it in 1939 rather than 1938, as he suggested, because production kits of the Zipper were not available in September 1938. A small error from a great man is readily accepted when handed up on the platter of fine remembrances that Corky shared with us.

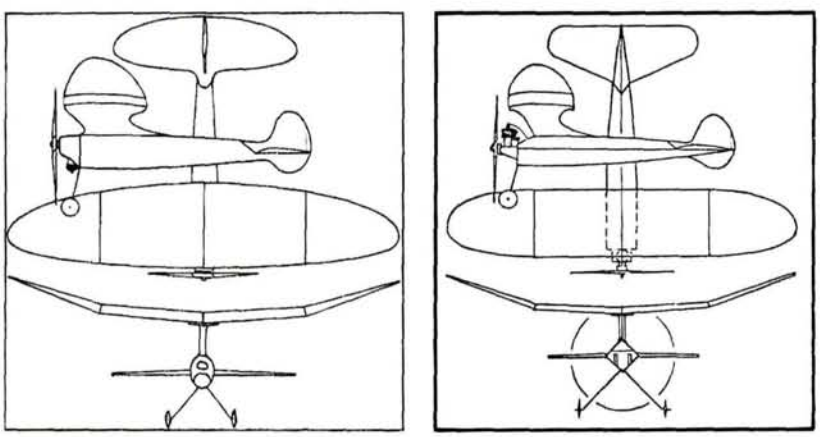
But to set the record straight, you are correct: the Comet Clipper was a cabin ship. It was designed as a follow-up to Goldberg's Valkyrie (Goldberg's first pylon design), in an attempt to provide a design that was smaller and simpler than the Valkyrie.

The Zipper was a response to a change in competition rules. Prior to 1938, free-flight gas was run with a set of rules that limited aircraft to a fixed amount of fuel. This favored large, slow-climbing, gas-sipping models. In 1938, however, the rules changed, and aircraft were limited to a 30-second motor run. Carl Goldberg looked at these limitations and saw fast-climbing, high-powered, smaller models and designed what is now referred to as the "Diamond Zipper." This was actually the prototype (10 to 12 were built) for what would become the production Zipper, and those who flew them proved the Zipper to be the plane to beat during the 1938 season.

In 1939, commercial kits for the Zipper were produced, with modifications in response to lessons learned with the prototypes. The commercial kits had rounded fuselages and elliptical stabilizers. Corky Meyer's Zipper is clearly a production Zipper and, thus, had to have been built during or after 1939. The Zipper dominated the 1939 Nationals with several hundred of them entered in the event. Interestingly, Carl Goldberg wasn't among those flying the Zipper; he was looking forward and flying what would eventually become the Comet Interceptor.

The Zipper changed the face of powered free flight, and many similar designs were produced in the early '40s. Interestingly, it was the Zipper and its spinoffs that determined the December 1938 cutoff date for eligible designs for the SAM antique event. Without that rule, the Zippers would rule in that event just as they did in 1939.

As for "Midwest bias" in our mailing: all of our magazines are handed to the U.S. Postal Service in Tennessee within a 48-hour time window. I'm not sure how that would result in distribution biased toward the Midwest, but with the U.S.P.S., anything is possible, I suppose. It may be that getting a letter from New Jersey to Connecticut is the hard part. LM



Left: the commercially available Goldberg Zipper. Right: the prototype version of the Zipper.

OLD GLUES ARE STILL GOOD GLUES

In Gerry Yarrish's "Thinking Big" column (March 1999), the author only mentioned three types of glue for modeling. While reading the article about Mr. Corwin "Corky" Meyer going "From Modeler to Test Pilot," I saw that Mr. Meyer noted that his flight instructor helped him in his transition from "... Ambroid glue to afterburner blow-outs," and this prompted me to write about a fourth type of glue: the type that should be most endearing to us older modelers. I'm talking about the old standbys such as Ambroid, Sig-ment and Testors wood glue. I, for one, have never used anything else. As Mr. Meyer stated, his fingers "always had layers of glue on them"; my fingers are still that way. These old standbys are still vital to building models. They are very workable and are excellent in fusing balsa to balsa, balsa to spruce, and balsa to plywood. Let's not forget our roots, bless them all.

DAN OWEN
Klamath, CA

It has been said that you can always tell a real modeler, because he knows where to buy Ambroid. I still think there's merit to that statement. You're right that the cellulose glues have their virtues. But Gerry started his column with the statement, "The three most popular glue types ..."; he didn't claim to list all the glues it's possible to use for building models. Rather, he stated a fact: that CAs, aliphatics and epoxies are used by the vast majority of modelers to form the vast majority of joints in modern model airplanes.

But many other glues are used in model building, including the cellulose-based glues. I often use the cellulose glues when I'm working on the exterior of a wood model; they sand better than anything else and leave no seams. I've built a lot of models in the past using only cellulose glues, but times change and glues improve, and I now use a variety of glues for every model I build. The glues Gerry talks about have become the staples of the modeling community because they do their jobs very well. LM

PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

READY FOR FIRST FLIGHT

Joe Owens of Las Vegas, NV, built this Pilot Christen Eagle kit about 15 years ago. Because it was his first scale project and it turned out so nicely, he hung it from his workshop rafters and recently decided he had enough time behind the sticks to fly it safely. The 52-inch-span model weighs 8 pounds, 8 ounces and is powered by an O.S. Max .91FX engine.

SOUTH AMERICAN CESSNA

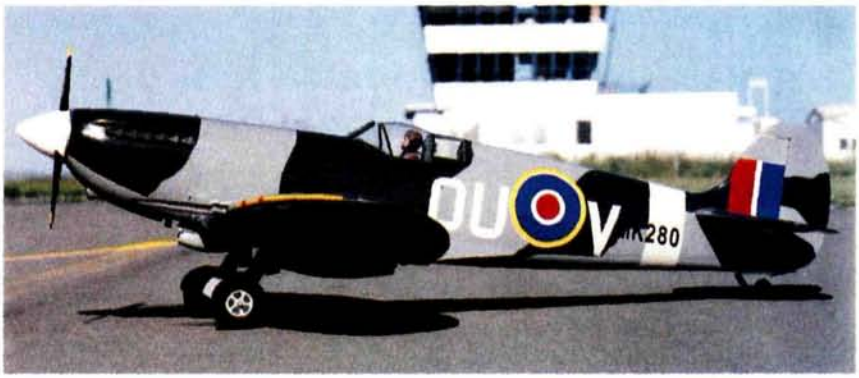
Rodolfo Simon and his father, both of Cochabamba, Bolivia, sent this photo of their Cessna 182 Skylane that they built from a Top Flite kit. The model has landing and navigation lights and a Top Flite cockpit. To avoid placing the throttle servo under the model's front hood, Rodolfo and his father put the servo in a little drawer that slides into the instrument panel in the cockpit. It is secured with screws.

MOTHER GOOSE

Wilbur McLeod of Castlegar, British Columbia, Canada, equipped his Ikon N'West Stinson SR8 with navigation lights, a leather interior with oak trim, sliding windows and cockpit lights that come on when the cockpit doors are opened. The Stinson is powered by a SuperTigre 3000 engine and uses a Hitec XF622 for control.

NEW ZEALAND SPITFIRE

Mervyn Matthews of Palmerston North, New Zealand, spent a year scratch-building this 1/7-scale Spitfire Mk IX from Brian Taylor plans. The 64-inch-span model is finished in Dulon lacquer and features the camouflage and markings of the WW II 485 Squadron (from New Zealand). An O.S. .70 4-stroke provides the power.



WASHINGTON BEAVER

Ed Marek of Renton, WA, built this 6.5-pound de Havilland model using a scale of 1.5 inch to 1 foot. It's powered by an O.S. .40 engine with a J'Tec Pitts-style muffler and has a spun aluminum cowl. Ed writes, "The covering is MonoKote, in a color combination I have seen on at least eight of the newly renovated Beavers at the Renton, WA, airport." The model has had more than 40 successful flights.

SUPERMARINE SPITFIRE

Alfred Siebert of Westminster, CO, built this 1/5-scale Spitfire from a Pica kit and airbrushed it using details from a Squadron Signal book. The 88-inch-span model features Robart air landing gear, a functional canopy and retractable flaps and uses a SuperTigre 2500 for power. Alfred writes that he and his young grandson Mike enjoy reading *Model Airplane News*.

AEROCOMMANDER CLONE

Adam DeLeon built this Great Planes Shrike while stationed at the U.S. Air Force base in Rapid City, SD. Adam now lives in Abilene, TX, where he flies the 80-inch-span, 13.5-pound model, which is equipped with O.S. .46 FX engines, Robart rotating retracts and Pro Mag aluminum wheels. The full-size Aerocommander in the background belongs to fellow modeler Chris Lund and his family.

ORANGEVILLE FLYER

A Lancair was the inspiration for this cute racer that was designed and built by Alf Mernary of Ontario, Canada. With a 62-inch wingspan, the model weighs 8 pounds and is powered by a .61 SuperTigre ABC engine. Alf writes, "After our club's flight instructor had the plane in the air for four flights and made several control and [CG] adjustments, it flew quite well. It will do about three rolls per second."

BORDER PATROL

Roy Parks of McAllen, TX, modeled this Cub after the first U.S. Border Patrol Super Cub in McAllen. He writes, "The first flights were very successful ... [it] flies very much like the man-carrying Cub." Roy's 110-inch-span model weighs 14 pounds and is powered by an O.S. 1.08 engine.

FOCKE-WULF 190

James Wilkinson of Panama City, FL, built his FW 190A-8 from Don Smith plans and outfitted it with scratch-built electric retracts, aluminum tailwheel and guns, which also function as the on/off switch. The 27-pound model is powered by an O.S. 300 twin engine and is painted with automotive acrylic enamel.

HINTS & KINKS

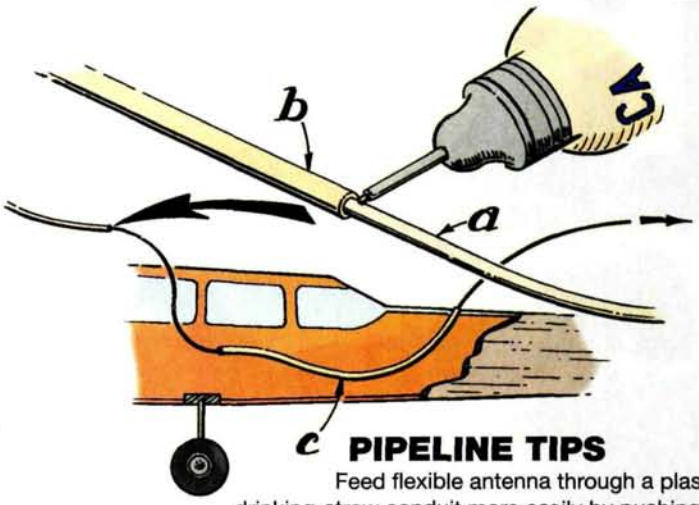
BY JIM NEWMAN

SEND IN YOUR IDEAS. *Model Airplane News* will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.

LET THERE BE LIGHT

Use a rubber band to attach a penlight to your motor tool to shed light into dark areas. A shim adjusts the light's angle. This is ideal when you drill or grind in the depths of a fuselage.

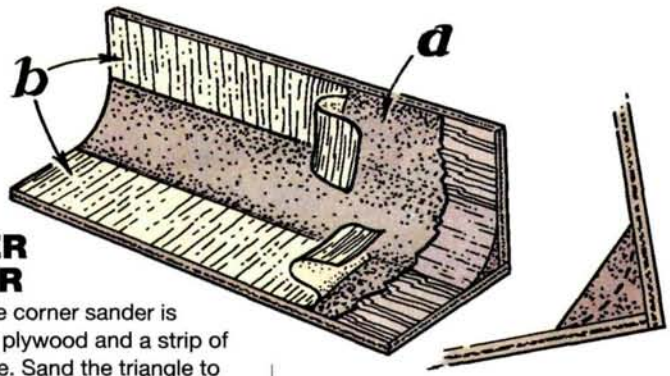
Bob Robert, Durrington, Wiltshire, England



PIPELINE TIPS

Feed flexible antenna through a plastic drinking-straw conduit more easily by pushing a stiff nylon monofilament into the exit end then butt-gluing the antenna (a) to the nylon filament (b) with a drop of CA. Pull on the nylon to draw the antenna through the tube (c), then slice off the nylon exactly at the join.

Paul Boucher, Rumford, RI



CORNER SANDER

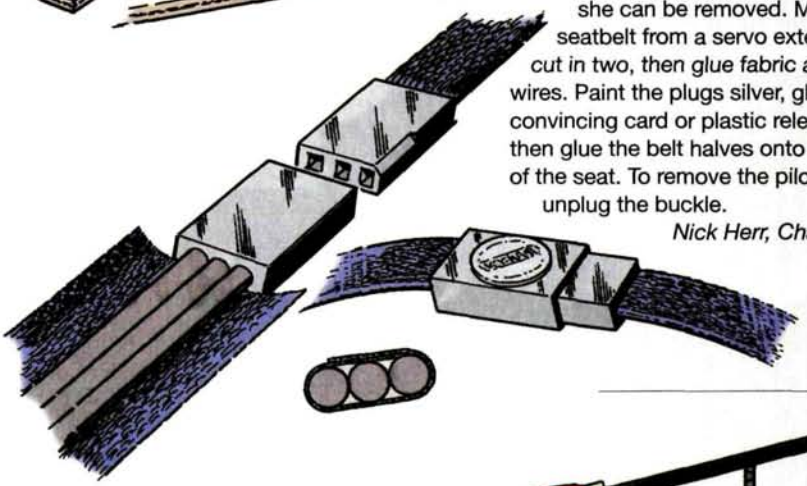
This fuselage corner sander is made out of plywood and a strip of balsa triangle. Sand the triangle to a radius, glue sandpaper (a) inside the tool, then mask off the flat areas with tape (b). The sander will produce a neat, constant radius on the fuselage corners.

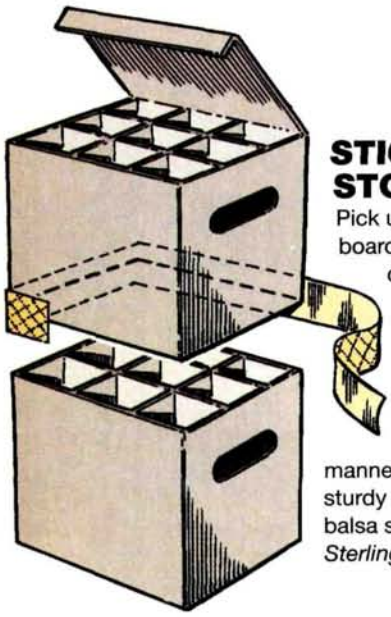
Kevin Pazda, Lakeland, FL

BUCKLE UP

Strap in your dummy pilot so that he or she can be removed. Make this seatbelt from a servo extension lead cut in two, then glue fabric around the wires. Paint the plugs silver, glue on a convincing card or plastic release button, then glue the belt halves onto each side of the seat. To remove the pilot, just unplug the buckle.

Nick Herr, Chapel Hill, NC

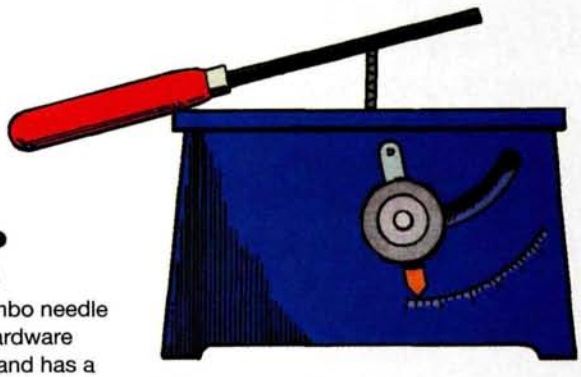




STICK STORAGE

Pick up a couple of cardboard shipping boxes with dividers from a wine merchant. Remove the bottom of one, then attach it to the other with adhesive tape. Join the dividers in a similar manner, and you will have a sturdy storage rack for your balsa strips and sheets.

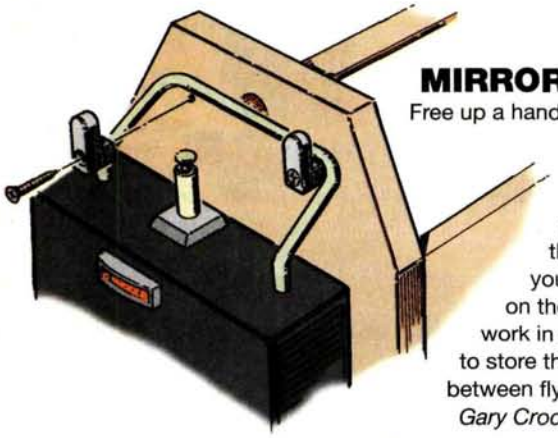
Sterling Hart, Midlothian, VA



A SHARP READER

A triangular jumbo needle file, found in hardware stores, is long and has a useful plastic handle that won't damage your Dremel saw table when you sharpen the blade. Fully crank up the blade, then stroke the teeth two or three times with the file. Work on alternate teeth, filing one side first, then the other. Study the teeth to see how it is done or consult a manual.

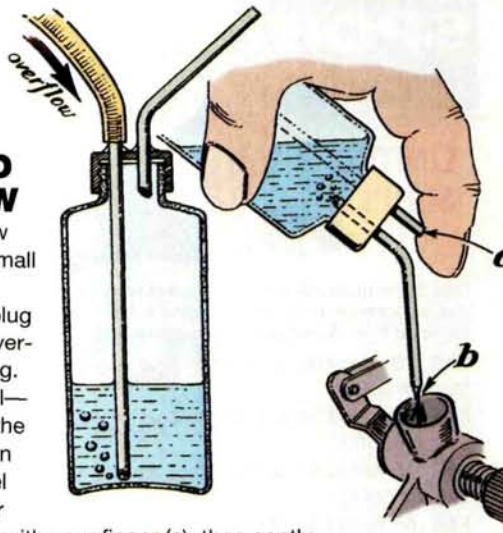
Jim McCurrach, North Vancouver, BC, Canada



MIRROR IMAGE

Free up a hand by screwing a pair of mirror-mounting clips into the end of your flight box then hanging your transmitter on them. This would work in your shop, too, to store the transmitter between flying sessions.

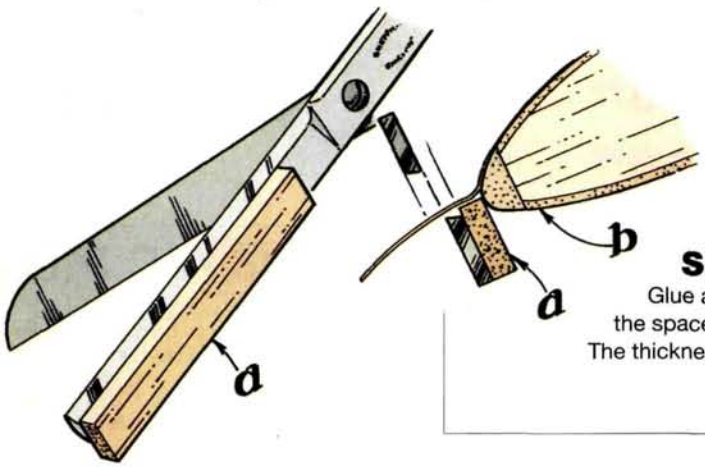
Gary Crooks, Overton, NV



RECYCLED OVERFLOW

Make this overflow catcher out of a small plastic bottle and brass tube, then plug it into your tank overflow when refueling. This saves the fuel—and the grass on the flying field! You can either pour the fuel back into its jug or seal the vent tube with your finger (a); then gently squeeze the bottle to prime the carburetor (b).

Tom Messing, Cheektowaga, NY



SPACED OUT

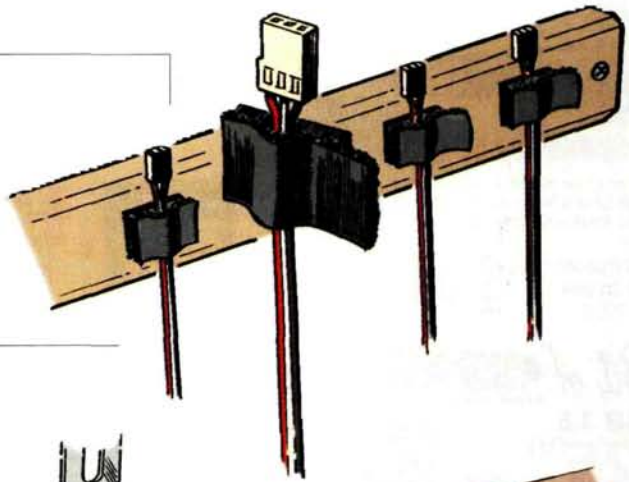
Glue a wood-strip spacer (a) to the side of your scissors, then touch the spacer to your wing (b), etc., when you cut off the covering material. The thickness of the spacer will control the overlap width.

Richard Teson, Vancouver, WA

HANGING AROUND

A strip of wood with squares of Velcro®-brand fastener glued to it nicely stores your charging and test leads. To secure each lead, just sandwich it between the squares. Note that the overhang creates a convenient pull tab.

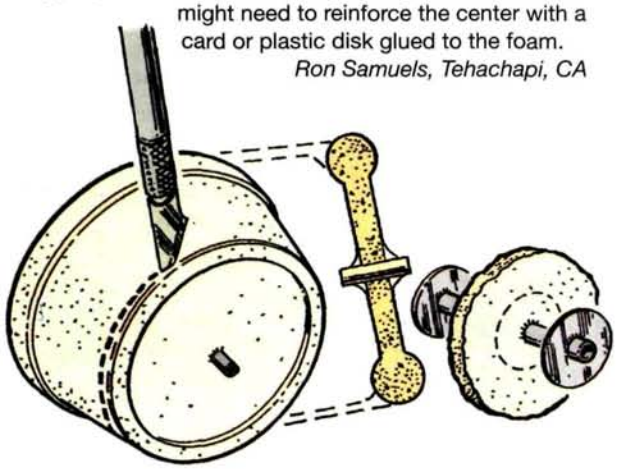
Eric Tull, McHenry, IL

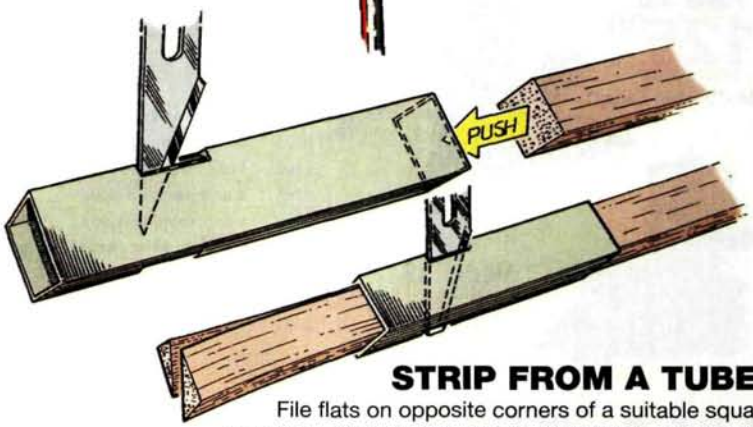


ULTRALIGHT WHEELS

Indoor R/C models need light wheels. Make them by cutting the bottom off foam cups then gluing the appropriate aluminum bushing through the center. You might need to reinforce the center with a card or plastic disk glued to the foam.

Ron Samuels, Tehachapi, CA





STRIP FROM A TUBE

File flats on opposite corners of a suitable square metal tube, then force a hobby knife blade into the slits, securing it with a dab of epoxy. Grind off the protruding point, and you can force square balsa sticks through the tube to create triangular stock.

Mike Maupin, Gray, TN

CYCLONE SPORT JET

This Cyclone was built from our turbine version kit. It is powered by a GWM FD 3/67 turbojet engine. It has 60" wingspan and weighs 12¼ pounds dry.

Our Cyclone Sport Jet is one of the most popular Sport Jets in the world. You have choice of 3 different internal ducting to suit your preferred package: Dynamax fan, Viojett fan or Turbine engine. We also manufacture 2 different wings for the Cyclone: the 50" sport wings and the 60" trainer wings. Since both wings match the same CG position, you can use either set on the same fuselage.

Special notes on the Cyclone kit: the vertical fin is molded in, the inlets are one piece split inlet, the wing removal system consists of high quality aluminum spars and "C" clamps, the gear plates are factory installed into the wings, the thrust tube is removable for easy maintenance.


Trainer wings 60"

Jeffrey Lynds


Sport wings 50"

Maynard Jubert


Large, rounded inlets already molded in.


Elev. servos located in the tail.

EMB-312 Tucano

1/6 scale, 72" wing, 64" long, 1.08 to 1.20.


Our Tucano on a low fly by

Our version of the Tucano is 72" span, at 1/6 scale. The recommended engine is .91 to 1.08 two strokes or 1.20 four strokes. The weight of the airplane is 10½ to 12 pounds, depending on the finishing method used. The airplane is fitted with a Rhom 3000 retract system with a modified nose gear (110 deg.). The airplane can perform all the aerobatics and is stable as a trainer.

DL's kits...versatility, quality and affordability!

We use the highest quality epoxy system to lay up our kits. All our epoxy glass components are pre-sprayed with a light coat of epoxy for a smooth surface. Our wings are cut from one pound virgin foam and all the sheeting is done with **epoxy glue, no contact cement**. All kits come with machine cut plywood parts, high quality balsa, vacuum formed plastic parts and canopy, very complete hardware package, instruction manual and plans.

Estrellita Sport Scale

¼ scale, 59" wing, 46" long, .46 to .61 engine.

Our Estrellita Sport Scale was designed as a sport flying airplane, not as a racer. Don't get intimidated by its sleek look, if you can fly a low wing model, you can fly it. At 5 pounds, with a .46 engine, it flies as a trainer and can easily top 120mph!

PRICE LIST, usd

Cyclone DR:	$599
Cyclone Turbine:	$849
Tucano:	$399
Estrellita:	$269

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Design and manufacture of radio controlled models

22nd Annual QSAA

by Jerry Nelson

Above: this A-26 Invader is the work of Bob Buckbee of College Station, TX. Powered by twin Quadra 75s, it weighs 87 pounds and has a wingspan of 178 inches. Built from Don Smith plans, it has a smoke system for each engine.

Nick Rivaldo's 133-inch-span, B-24D Liberator bomber flew several successful missions over the Nevada site; four Magnum .61s.

ONE OF THE longest-running (22 years), giant-scale events in the U.S., the annual Quarter Scale Association of American (QSAA) Fly-In is held in Las Vegas, NV, in October (the 15 through 17, in '98). There were 188 aircraft entered, and as is usual for the QSAA Fly-In, they represented every type of scale aircraft—everything from Cubs, DC-3s and Space Walkers to Corsairs, P-51s and an A-26 bomber. There was something for every interest in aviation, and every one was a beauty.

On the first day, we enjoyed a show-and-tell static display and checked out what the manufacturers had to offer in the trade show at Sam's Town Casino. The static display allows spectators to take a really close look at the models and talk to their owners—a great way to learn. At least 30 vendors of giant-scale goodies were there to show their latest and greatest to what they agreed was a good turnout of scale enthusiasts. (There must have been several hundred motor homes as well as cars! Luckily, there's unlimited parking!) Some of the vendors joined us for the rest of the event and set up on the flightline. Where did we go? As always, we headed out of town about 10 miles for two days of flying at a dry lake bed. This site is just superb—several miles long and quite smooth—but the weather on Friday wasn't quite as great. In fact, we needed our jackets, and the wind was so high that only a few modelers flew.

On Saturday, we were relieved to see that the wind had died down, and what was left didn't stop anyone who wanted to fly from doing so safely. After waiting it out on Friday, the pilots were more than ready, and the flying was nonstop all day.

At noon, we were treated to several demonstration flights by unique aircraft, including some brought along by vendors. Not only did we see these products on display, but we also watched demo flights that showed the aircraft being put through their paces.

The work of Noel Hess, this impressive, 122-inch-span Curtiss T-32 Condor airliner is a sight to behold; two O.S. 1.20 4-strokes.

Robert Gray's attractive, Golden Age, 89-inch-span 1929 Vellie sport monocoupe is powered by a SuperTigre .61.

Big fun in

David Smellie's Balsa USA 1/3-scale Super Stearman flew beautifully behind its Sachs 5.8 powerplant.

GIANT-Scale Fly-In

Gary Larson of Ogden, UT, flew his nicely done Bud Nosen Mr. Mulligan—a 107-inch-span model powered by a Zenoah G-62 gas engine.

Built by Don Thorson, this 96-inch-span Spirit of 76 Waco UPF-7 is powered by a Robart 7-cylinder radial engine—plenty of power for an impressive flight performance.

Las Vegas

QSAA

Noel Johnston's beautiful, 103-inch-span, P-51B Mustang fighter sits proudly on the QSAA's dry-lake-bed runway; Brison 5.8ci engine.

STANDOUTS

• **Best Civilian (1914 to 1955).** A regular at the QSAA Fly-In is Noel Hess of Salt Lake City, UT. His impressive, 122-inch-span, Curtiss T-32 Condor biplane powered by two O.S. 1.20 4-strokes earned him the "Best Civilian " award. I don't think there has ever been a year in which Noel didn't earn some kind of award.

• **Best Warbird (1936 to 1945).** This went to Noel Johnston (Fruit Heights, UT) for his beautiful, 103-inch-span P-51B fighter. Noel built the razor-back Mustang in ¼ scale and powers it with a Brison 5.8ci engine. With its retracts, flaps, full cockpit detailing and excellent markings, this fine aircraft would be competitive at any scale meet.

• **Mechanical Achievement.** Nick Rivaldo (Long Beach, CA) put in many excellent flights with his 133-inch-span, 41-pound B-24D Liberator bomber, and his win in this category was certainly well-deserved. Four Magnum .61 glow engines power this monster; just try to get four of these running in sync and you'll appreciate why I say "well-deserved"!

• **Best Aircraft (pre-1914).** Mike Hawkins came all the way from Bangkok, Thailand, to fly a superb, ¼-scale, Nieuport 11 Bebe that emerged victorious in the pre-1914 category. The 74-inch-span WW I fighter is powered by an O.S. 1.20 Surpass 4-stroke and beautifully finished with System Three paint. I'm sure you won't be at all surprised to hear that Mike also went home with the "Traveled the farthest to the event" award! That's dedication!

This 140-inch-span Douglas DC-3 was built by John Dalton of Topeka, KS, from Nick Ziroli plans. It weighs 46 pounds and is powered by two Quadra 35s.

From Tucson, AZ, Chuck Brooks earned the Best Pre-WW II award with this 88-inch-span, 1/4-scale de Havilland Tiger Moth powered by an O.S. BGX-1.

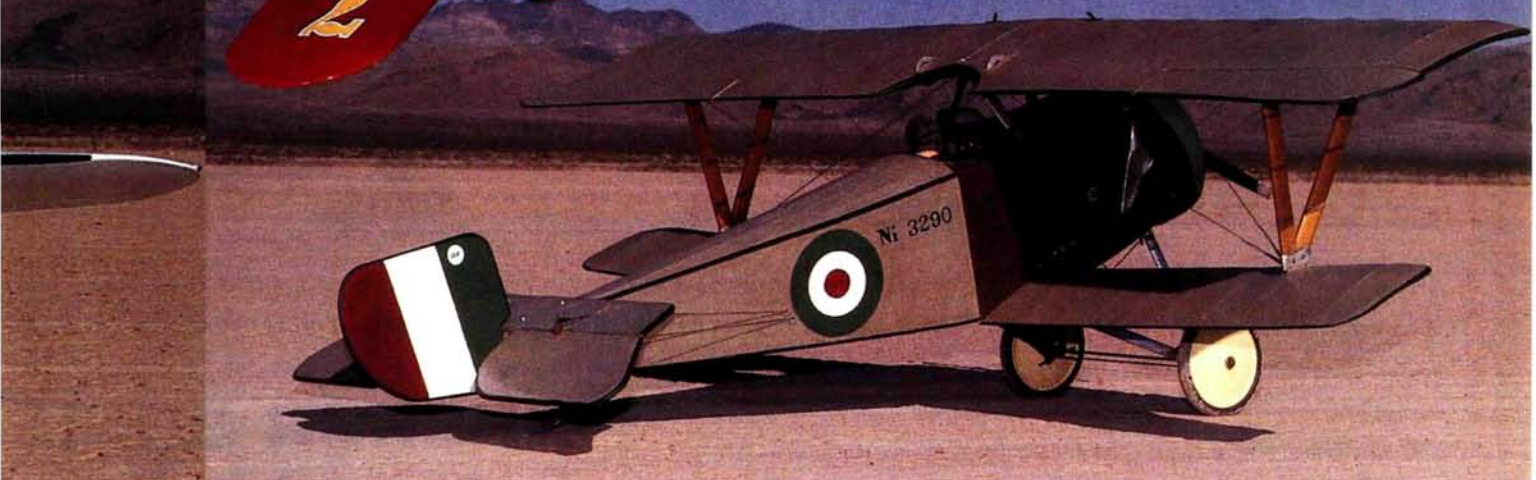
Winners

Award	Pilot	Plane
Best Aircraft (pre-1914)	Mike Hawkins	Nieuport 11 Bebe
Junior Achievement	Melanie Lindstrom	Piper J-3 Cub
Static Display	William Lewis	de Havilland DH-1
Best Civilian (1914-1955)	Noel Hess	Curtiss T32 Condor
Best Civilian (post-1955)	Quniton Penica	Airtruck
Best Pre-WW II (1914-1935)	Chuck Brooks	Tiger Moth
Best WW II (1936-1945)	Noel Johnson	P51B
Best Military (post-1945)	Bob Buckbee	Tigercat
Best Mechanical	Nick Rivaldo	B24D
Best Finish	Kurt Van Leeuwen	Extra 300
Best of Show	Dan Molinsky	P61 Black Widow

Greatest distance traveled to event: Mike Hawkins—Thailand

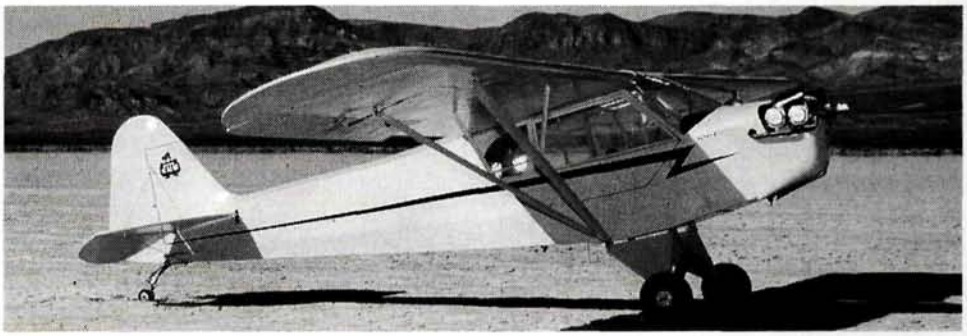
Below: this 86-inch-span Gilmore Red Lion racer belongs to Steve Parola. Power comes from an A3 5.7 racing engine turning a 20x20 prop.

Mike Hawkins came all the way from Thailand to fly his 74-inch-span, O.S. 1.20 4-stroke-powered Nieuport 11 Bebe. It earned him the Best Aircraft (pre-1914) award.



• **Junior Achievement.** It is so nice to see young people participate at flying events. Nine-year-old Melanie Lindstrom and her dad, Kevin, came from Ontario, CA, so she could show us how with her Piper J-3 Cub. Built from a Dave's Models ARF kit, Melanie's 104-inch-span Cub has a Magnum 1.60 twin for power.

David Smellie (Layton, UT) held my attention with some really great aerobatics. Powered by a Sachs 5.8ci engine, his impressive, 116-inch-span, Balsa USA Super Stearman biplane is equipped with a smoke system for real scale authenticity, and David really knows how to fly that thing.



Robert Gray's 105-inch-span, 1.20-powered 1/4-scale Piper J-3 Cub.

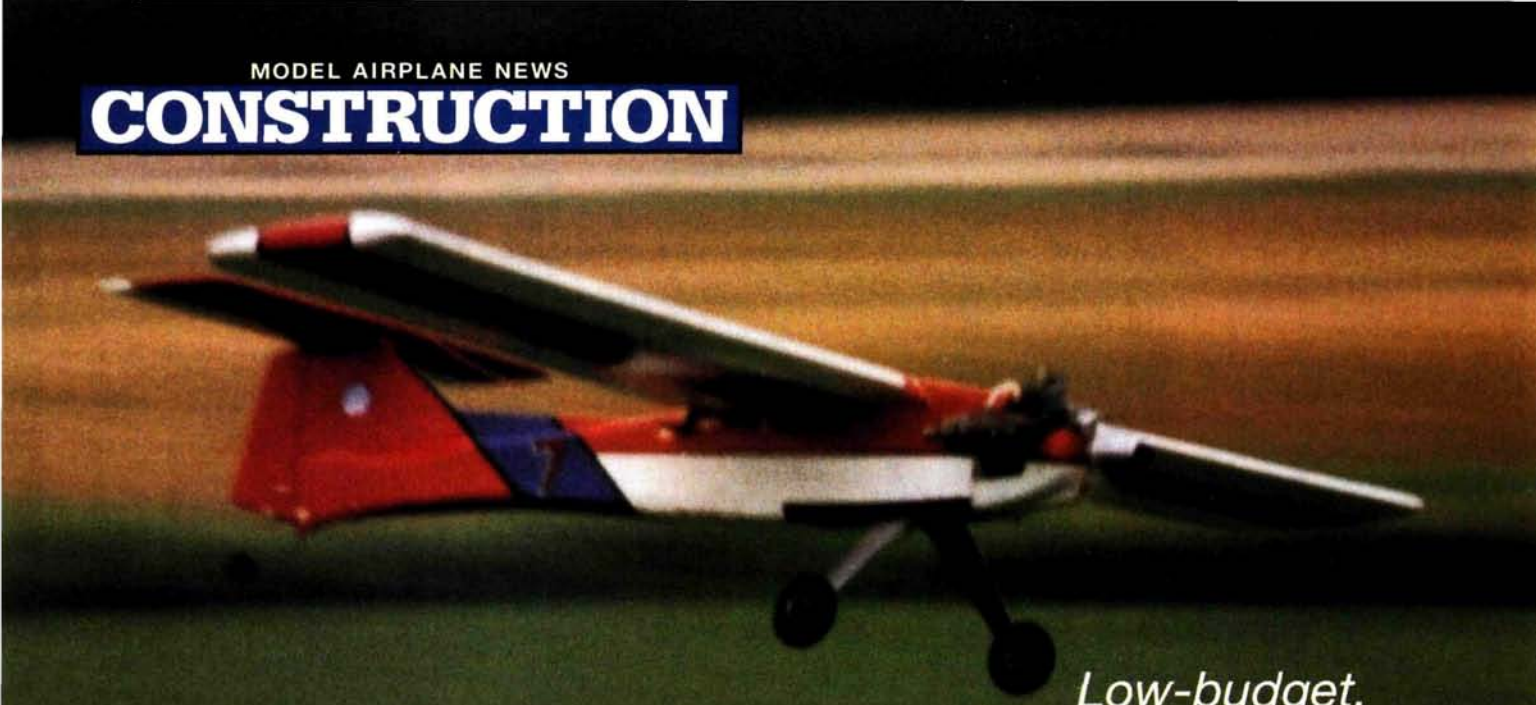
Nine-year-old Melanie Lindstrom poses proudly with her 104-inch-span J-3 Cub. She had a great time flying it at the event; Magnum 160 twin for power.

NO HANGAR QUEENS!

Though we attend this type of event for the flying, I'm sure we'd all admit that the awards banquet is just as important a part of the total event experience. The QSAA Saturday-evening banquet and awards presentation at Sam's Town Casino was worth looking forward to.

The QSAA has a great way of picking the winners in the 12 categories: participants *vote* to decide the best models. Except for the static-display competition, to be eligible for this "election," a model must have been flown during the Fly-In—no hangar queens here! I think this is a great way to promote laid-back competition.

Now it's time to think about the 1999 QSAA Fly-In. It offers ample opportunity to fly several times a day, so if you haven't already attended, why not take your 1/4-scale model along this year and fly with the best? Mark October 14 through 16, 1999, on your calendar. There's plenty of room for everyone, and I hope to see you there.



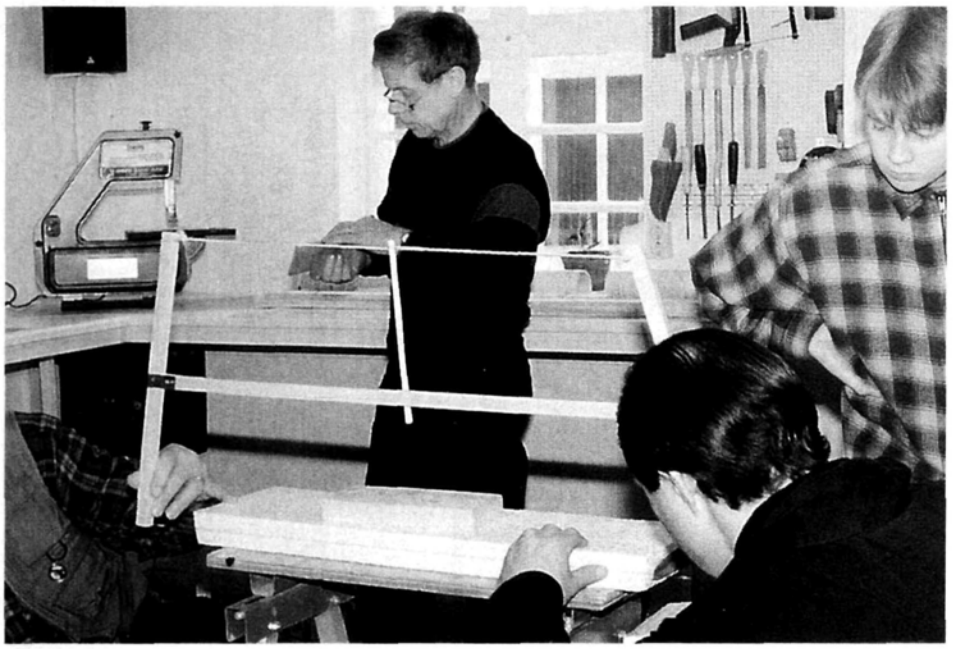
Low-budget, versatile sport plane

by Bertil Klintbom

FENIX

THE FENIX IS A SPORT model designed for both beginners and advanced modelers. It is fast and maneuverable and capable of everything you want it to do. The Fenix has a wide speed envelope, and it is a light but strong model that can withstand hard handling. It is also a low-budget model that needs a minimum of material. If you can fly a trainer model, you'll find that flying the Fenix is uncomplicated and a sheer joy. With a powerful engine, the Fenix is very capable, and if you fly it on low throttle or combine it with a smaller engine, it is possible to use the Fenix as a trainer.

All engines between .40 to .46 2-stroke or .41 to .61 4-stroke suit the model. If you plan to use a 4-stroke, you may have to adjust the cowl to provide more space. I have seen the model fly with a Laser .75, and it really moved and had an enormous amount of torque. My recommendation is a regular .40 engine.



Club members use a hot wire to cut a Fenix's wings.

SPECIFICATIONS

Name: Fenix

Type: sport model

Designer: Bertil Klintbom

Wingspan: 55 in.

Wing area: 495 sq. in.

Length: 37 in.

Weight: 4 lb.

Radio req'd: 4-channel (throttle, elevator, aileron, rudder)

Engine recommended: .40 to .46 2-stroke or .41 to .61 4-stroke

Engine used: .40

Comments: designed for both beginners and advanced modelers, the Fenix is fast and maneuverable. It has a wide speed envelope, and it is a light but strong model that can withstand hard handling. It is also a low-budget model that needs a minimum of material.

PREPARATION

Start by cutting out a kit for the model. The parts are shown on the plans. Cut former F1 from 6mm (¼-inch) plywood and the other formers from 3mm (⅛-inch) plywood. The reinforcement part F4 should be cut out of medium-grade balsa. The fuselage is a box with fuselage sides of 2mm (3/32-inch) balsa. Be careful to use balsa sheets of the same stiffness for the fuselage sides to make it easier to bend the parts to the same curvature. Cut the remaining details, such as the stab, fin, elevator and rudder, out of balsa. The wing is cut out of white foam with the help of the template shown on the plan.

BUILDING THE FUSELAGE

Use regular white glue and epoxy (I seldom use CA, but the choice is yours). Use a flat building board with a centerline. Glue F4 and the reinforcements for the dowels to the fuselage sides. Remember: you need one left and one right side. Glue formers F1 through F3 to the fuselage sides and align them with the line on the building board to make everything straight.

When the glue has dried, continue with the remaining parts, such as balsa sticks and formers. Plank the upper and lower sides of the fuselage with 1.5mm (1/16-inch) balsa sheets glued in crosswise. Remember the cutout in the upper planking for the fin. Epoxy the plywood parts for the landing gear and tailwheel to the fuselage. Drill the holes for the engine mount, fuel-tank tubing and linkages.

FLYING SURFACES

The fin is made of three parts cut out of 5mm (3/16-inch) balsa sheets. Note on the plans how the grain in the wood is directed to get the proper stiffness. The fin goes all the way down to the bottom sheeting of the fuselage. The stabilizer is also built up from parts. The plan shows a stabilizer of 3mm (⅛-inch) balsa; you could also use 5mm (3/16-inch) balsa but it is not necessary for strength. My stabilizer is covered with thin glass cloth and epoxy resin. Please note the triangular stock reinforcements on the bottom side of the stabilizer. The fin should be pushed into the slot in the stabilizer and glued. The negative angle for the stabilizer is important and should be correct if you have cut and glued the parts as shown on the plan. You could rig the stab if you want; it is not needed for the structure but could be nice to look at. Glue the fin and the stab to the fuselage, and glue the plastic rod to the front of the fin with the spin strake. Be careful to get the correct angles when you glue the parts together permanently!

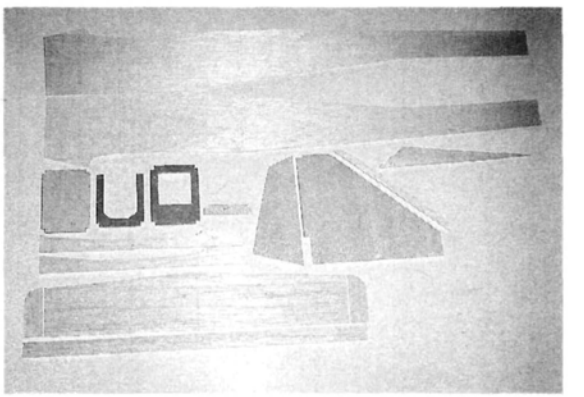
With a hot wire, cut the wing-core out of Styrofoam, using the template on the plan to get the correct airfoil. Glue the leading and trailing edges to the cores and decide which planking to use: veneer, balsa, or brown paper. My model has a wing covered with regular brown parcel paper. This gives you a very strong surface with a high finish. Glue the wing halves together using the 3mm (⅛-inch) plywood dihedral brace and add 10mm (⅜ inch) of dihedral to each wing panel.

COVERING

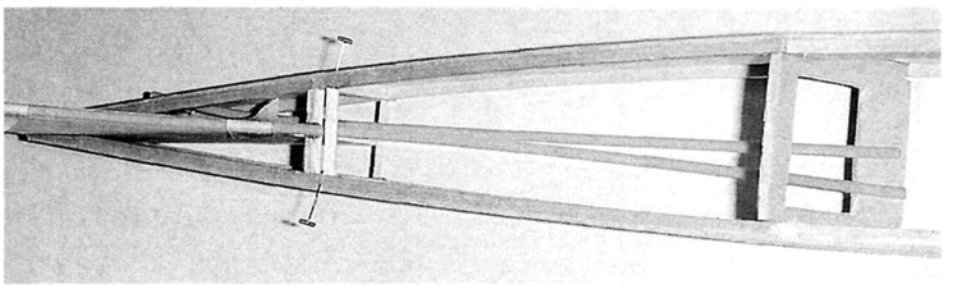
Sand the fuselage and cover it with your favorite covering; I always use Sig* Koverall. Lightly sand and fill in the small dents in the wing-cores and the balsa parts on the wing panels.

You can cover the wing in two parts or with the panels glued together (I prefer the latter). Remember to add the 0.4mm plywood reinforcement on the wing's upper side. Mix regular white glue and water (60:40) and add a few drops of food

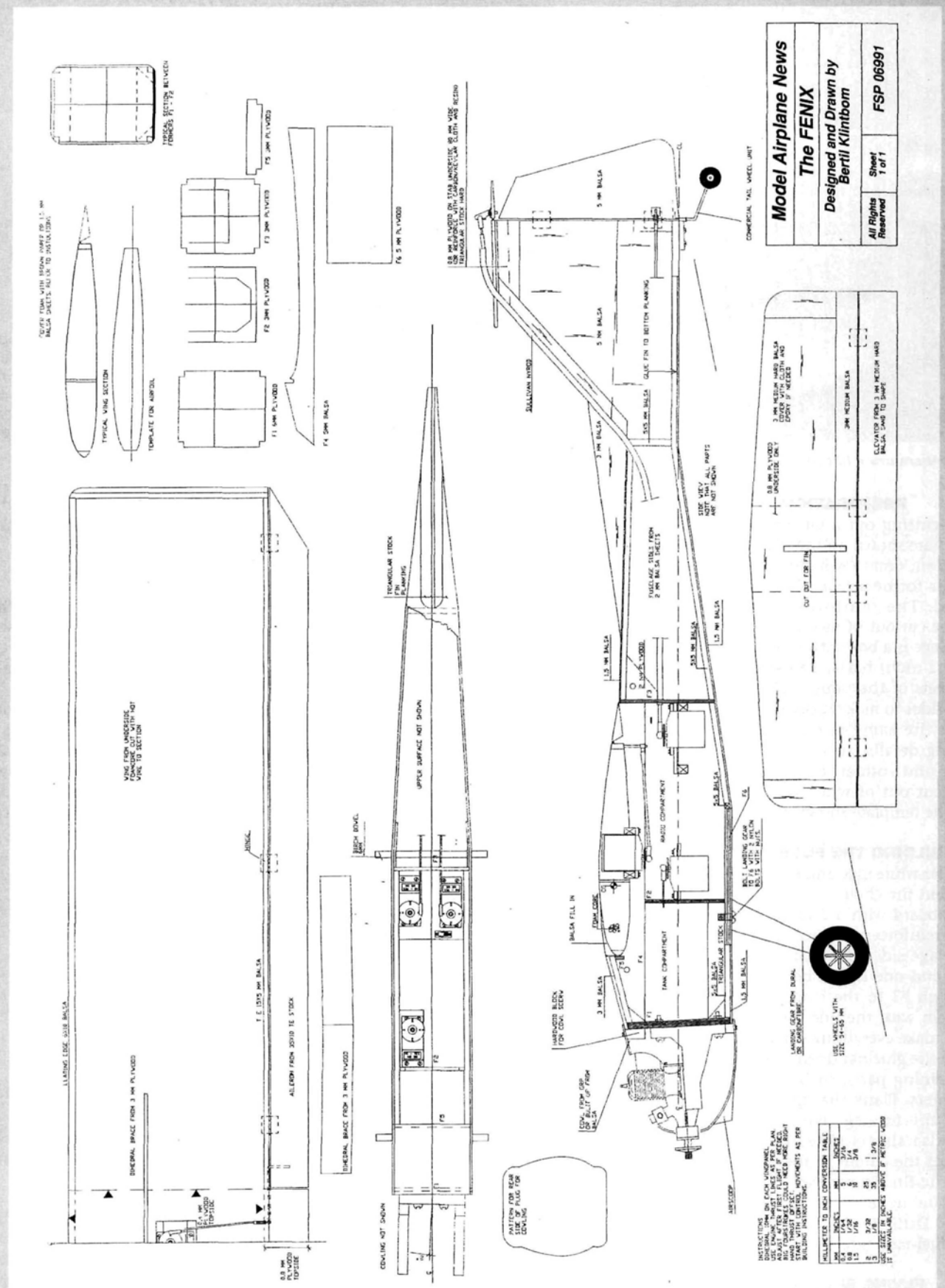
Text continued on page 38



The cut-out wood parts are ready to be assembled.

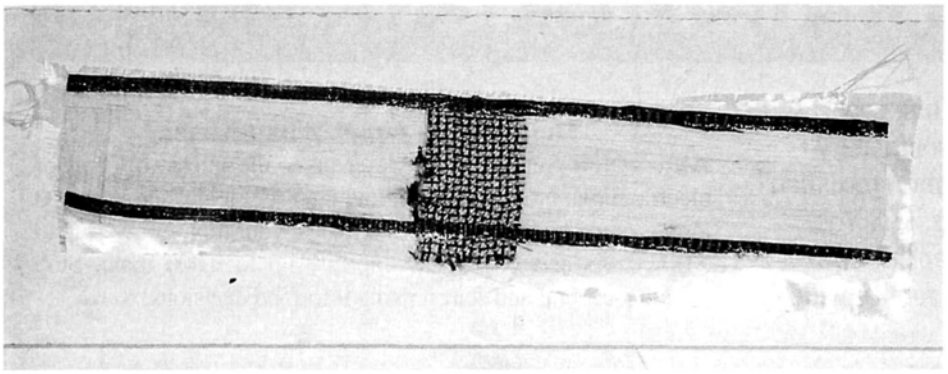


The tubes in the fuselage hold the pushrods.



FSP06991

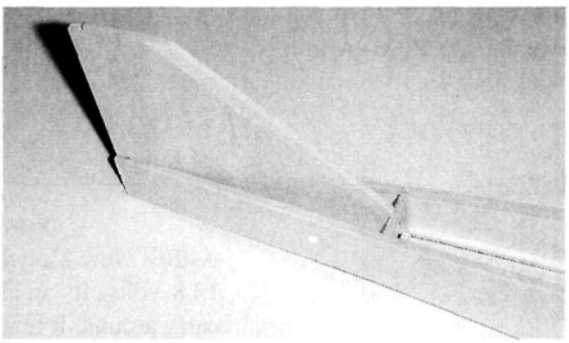
Designed by Bertil Klintbom for both beginners and advanced modelers, the Fenix is fast and maneuverable. It is a light but strong model that can withstand hard handling. It is also a low-budget model with a minimum of material needed. If you can fly a trainer model, you'll find that flying the Fenix is uncomplicated and a sheer joy. WS: 55 in.; L: 37 in.; weight: 4 lb.; radio req'd: 4-channel; engine req'd: .40 to .46 2-stroke or .41 to .61 4-stroke; 1 sheet; LD 2. **$14.95**



The stabilizer is glassed with cloth and epoxy resin. The black cloth is carbon/Kevlar reinforcement (as per the plans, plywood works well, too).

coloring. Cut a piece of regular brown parcel paper to get two parts a little smaller than the wing undersides and two parts that are about 20mm (¾ inch) bigger than the upper sides in all directions. If there is any grain in the paper, it should run lengthwise to the wing. Start to brush the mixture to the underside of the wing. Now you see the reason for the food coloring: you can see where you have applied the glue. Brush the mixture to the matte side of the paper and carefully place the paper on the core. Remove any wrinkles with a dry cloth. Repeat for the upper side, but the paper should now go over the joint on the wing underside. Cut the paper with scissors a few times so it will curve around the wingtips; repeat for the next wing panel. The secret is to work quickly before the paper starts to bubble. You have to cover the entire wing at once and then hang it to dry; do not leave it on your workbench. It will now start to look really ugly—a complete disaster. But in a few hours, it will start to dry and become more and more smooth. Let it dry for 48 hours, then brush on a mixture of equal parts of glue and water, and let it dry again for at least 24 hours. Any unwanted warps will cure in a few days. Finish the surface with any filler; I use an old-time method of dope mixed with talcum powder. You can sand and fill the imperfections on the wing and create a perfect finish for any painting method.

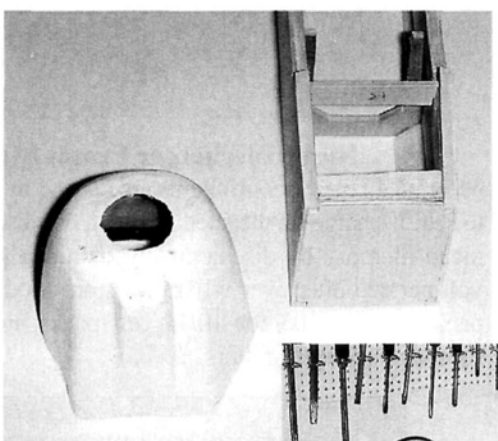
When you mount the moving surfaces, remember to lock them with glue and pegs. The model flies fast, and the loads can be high. If you haven't mounted your radio gear, it is time for that now.



The vertical stabilizer in place.

THE COWL

The plans show a fiberglass cowl, although you could also make one out of balsa and plywood. To make a fiberglass cowl, glue a piece of high-density (usually blue or pink) foam to former F1. Cut and sand the foam to the desired shape and sand it to a smooth surface with a fine-grade sandpaper. Cut away the completed plug from the fuselage. Fill any imperfections with a filler and sand it again. Finish off with three or four layers of paint, wet-sanding between each layer. Be sure that the paint will not attack the foam! Now wax the plug four or five times with old-fashioned car wax.



The completed cowl is ready to be finished.

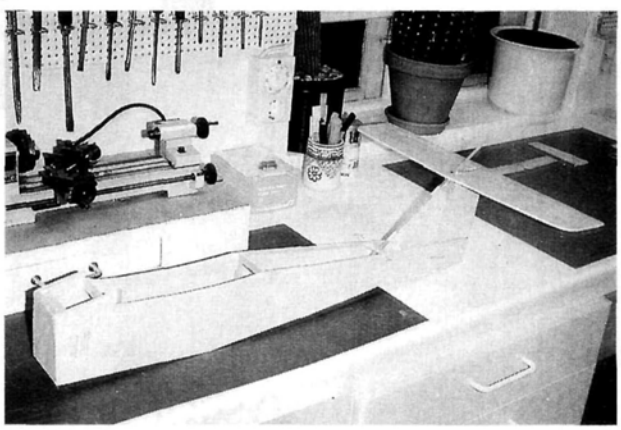
If you are going to use the mold for more than two or three cowls, I recommend that you make a fiberglass mold. If the mold is intended for only one or two cowls, you can use plaster of Paris. Make the mold as follows.

Glue the plug to a glass sheet or Formica surface with hot glue. Mix the plaster and pour it over the plug, and make sure that you get at least 15mm (½ inch) of plaster over the entire plug. Let it dry for at least 24 hours before you take the plug away, in one part or in pieces. You now have a negative mold. Fix any imperfections in its surface with plaster. Let the mold dry for three to five days, then wax the inner surface with five layers of car wax. Polish only the last layer. Mix equal parts white glue and water, and brush the mixture on the inner surface of the mold to act as a release agent.

Now start with the polyester or epoxy resin and fiberglass cloth. Brush one or two layers of gelcoat on the surface; when it is tack dry, continue with layers of resin and cloth. After approximately 24 hours, you can carefully remove the part from the mold and trim it to fit the engine. If the part sticks to the mold, just put it into warm water and let the glue layer soften. Wet-sand the finished cowl and mount it to F1 with screws and hardwood blocks.

FLYING THE FENIX

Check the center of gravity with all parts installed but without fuel in the tank. Adjust the radio gear to control movements as per the plans. Do not add more elevator throw, as it is quite sensitive. The Fenix takes off easily, so you should have no problems at all. When you have gained altitude, trim out the model and start to get the feel of it. Try to stall the model so that you'll know what to expect when it is time to land. You will notice that you can fly very slowly or very fast with good control response and that most aerobatics are possible. Inverted flight is good; only a little down-elevator is needed. Land before the model runs out of fuel. The Fenix floats out well, so make a low approach and touchdown. Adjust the control movements if necessary and fill up for a new takeoff. Happy landings!



Assembly is nearly complete.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

BUILT-UP MODELS take a long time to build and set up. What do you do if your lifestyle simply includes little or no time to build? Heck, it's hard enough to just find time to go to the flying field on a regular basis. The lack of building time is why ARFs are so popular today. ARFs may never be a consideration for some diehard builders, but over the past several years, prebuilt models have become pretty impressive alternatives to build-it-yourself models. ARFs may never completely overshadow kit-built models, but they sure do get you to the flying field in a hurry!

The Ultra Series of prebuilt models from Hangar 9* is a good example of what ARF can mean: good quality and value for your money. The latest addition to the series is an IMAA-legal CAP 232. This high-performance aircraft comes—as do all the Ultra Series aircraft—90 percent assembled and factory-covered with Ultracote film. The first time you open the kit box, you will realize that this CAP is much more than just an ARF.

1/4-scale high-performance ARF

by Gerry Yarrish

HANGAR 9 CAP 232

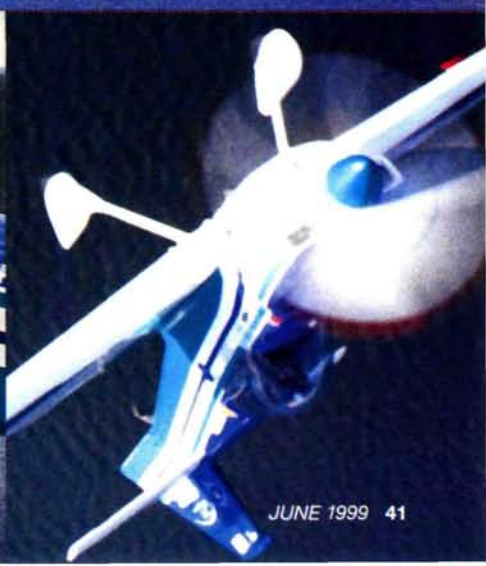
THE REAL THING: MATT CHAPMAN'S CAP

As a member of the United States World Aerobatic Team, Matt Chapman has thrilled crowds everywhere with his full-scale CAP, on which the Hangar 9 CAP 232 is based. In 1998, flying against the best pilots in the world, Matt rolled, looped and spun his way to a bronze medal in the World Aerobatic Competition.

Matt's typical aerobatic sequence subjects him to as many as 10 positive G and to mind-bending roll rates in excess of 400 degrees per second! In addition to international aerobatic competition, Matt flies his distinctive CAP on the national airshow circuit,

astounding onlookers with his freestyle performances.

As an avid radio control modeler, Matt also enjoys flying his JR Ergo 60 Sport helicopter as well as a Carden Extra 300S. If you plan to go to a full-size airshow this year, be sure to watch for Matt and his impressive performance in the CAP 232.



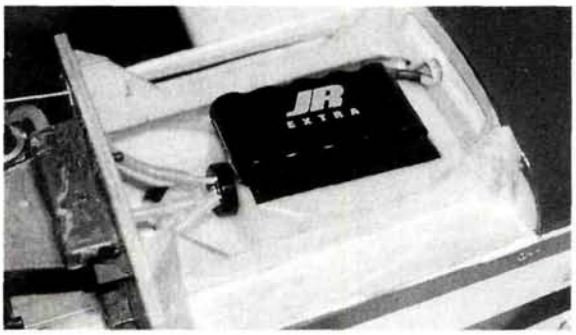
IN THE BOX

There are 10 precovered, built-up wood parts for the CAP 232: the fuselage, two wing halves (ailerons already hinged), the hinged rudder and fin and the hinged horizontal stab and elevator halves. The engine cowl and wheel pants are made of fiberglass and come painted to match the Ultracote finish. Also in the kit are a complete hardware package, an instruction manual, a formed canopy and stick-on decals for Matt Chapman's IAC-winning airplane. Hardware items include aluminum landing gear, wheels, engine mount, fuel tank, control horns, clevises and a pull/pull rudder cable set. All the hardware is good-quality stuff from Du-Bro* and Sullivan Products*.

THE WING

The kit comes with CA-type hinges already in place, but they do have to be glued. Begin assembling the model by gluing the aileron hinges into place. Don't be afraid to use this type of hinge; I have several flights on the CAP, and the hinges show no signs of fatigue or wear. It's unnecessary, but if it makes you feel better, you can install additional hinges on the control surfaces by adding a hinge between those already there. Use thin CA and wick five or six drops of adhesive into the hinge slots on either side of each hinge. Let the glue soak into the wood and work the control surfaces back and forth as the glue sets. Make sure that you maintain a 1/16-inch gap between the root end of the aileron and the TE of the wing.

Once the ailerons are in place, join the wing panels with the supplied dihedral brace and some 30-minute epoxy. I encountered a slight snag here. The instructions call for 3 inches of dihedral under a wingtip when the opposite panel is flat on the building board. When the wing roots are brought together, the angle sanded into them provides close to 4 inches of dihedral. I glued the panels together while retaining the 3-inch dihedral. This left an 1/8-inch gap at the top of the wing when the root rib bottoms were touching each other. I mixed some Prather Products* microballoons with 30-minute epoxy and filled the gap; it took several applications to completely fill it. This produced a strong wing-panel joint and did not require me to sand a new joint angle. After the panels have been joined, add a plywood faceplate, two wing hold-down dowels, the aileron servos and the control horns to finish the wing.



With the engine cowl removed, access to the fuel tank and battery pack is totally unrestricted. I used a JR 1,100mAh 5-cell pack to power the radio.

Though the instructions say to install the plywood wing-bolt plates now, I found it easier to wait until I mated the wing to the fuselage. This way, I could align the holes in the plates with the holes I drilled in the wing's TE for the mounting bolts.

FUSELAGE

There are two large holes in the former just in front of the wing saddle. Small plywood support plates (with holes drilled in them that fit the wing hold-down dowels), are glued into place behind the large holes. Place the wing in the saddle so the wing hold-down dowels fit into the large holes. When the wing is centered in the saddle, slip the plywood support plates over the dowels, and push the plates flat against the front surface of the former; tack-glue them into place. Remove the wing and then permanently glue the plates into position.

The wing's hold-down bolts match up to blind nuts that must be installed in the wing hold-down block that's already glued into place in the fuselage. In my kit, this block had broken free during shipping, so I simply glued it back into place with epoxy. It fits snugly into

SPECIFICATIONS

Name: CAP 232

Type: 1/4-scale aerobatic monoplane

Manufacturer: Hangar 9

Wingspan: 73 in.

Wing area: 1,031 sq. in.

Weight: 11.5 lb.

Wing loading: 25.14 oz./sq. ft.

Length: 67 1/4 in.

Engine range: 1.08 to 1.20 2-stroke; 1.20 to1.50 4-stroke

Engine used: Saito 1.50 4-stroke

Radio req'd: 4-channel (ailerons, rudder, throttle, rudder)

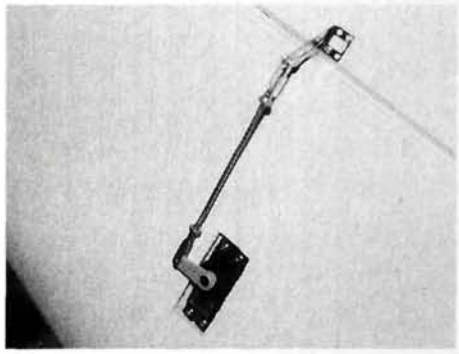
Radio used: JR 8103

Price: $329.95

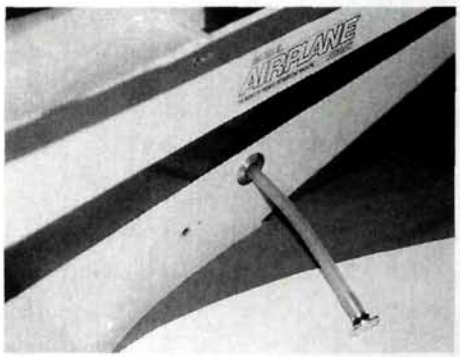
Comments: the Hangar 9 CAP 232 is an impressive, high-performance ARF that comes factory covered in Ultracote. The fiberglass parts come painted, and I was able to completely assemble the model in a little over 10 hours.

Hits
- Excellent flight characteristics.
- High-quality hardware included.
- Easy and quick to assemble.
- Good value for the price.
- Fiberglass parts come painted.

Misses
- Wing had too much dihedral angle cut into the panels (see text).
- Wheel axle bolts bent easily. (I replaced them with Du-Bro wire axles.)

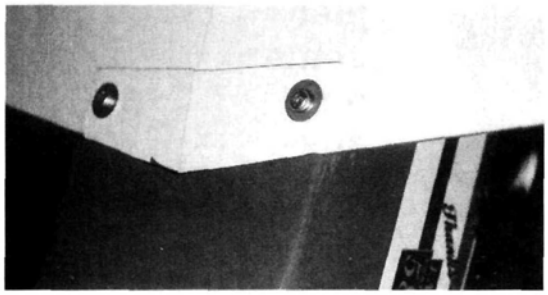


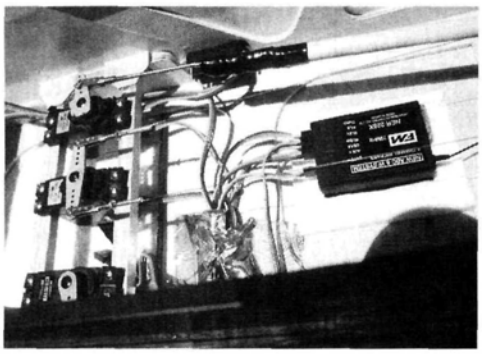
The aileron servos are just in front of each aileron and require a servo-lead extension. I used Du-Bro heavy-duty servo arms on all the servos. Note the metal Sullivan control horns; they come with the kit.



I used a Reid's Quality Model Products* Fuel-It fitting to simplify getting the tank full. Used with a 3-line fuel system, the Fuel-It is on the side of the model, just above the wing.

To fill out the cockpit, I used a 1/4-scale pilot and a Hangar 9 scale instrument panel. This pilot knows what he's doing; note the Aresti flight schedule mounted on the clipboard.





Glue these plywood plates on the bottom of the wing after you have drilled the bolt holes in the wing's TE. Minor trimming is required.

There's plenty of room in the fuselage for any radio. Note the lightweight construction and the use of white Styrofoam for the fuselage top.

notches in the fuselage sides, so alignment is not a problem.

To transfer the wing hold-down bolts from the fuselage to the wing, place the bolts backwards in the blind nuts. With the fuselage upside-down, screw the bolts out of the blind nuts so that about a ¼ inch of each bolt protrudes above the wing saddles. Place the wing in the saddle and measure from each wingtip to the tail post to make sure that the wing is placed squarely on the fuselage centerline. Tape the wing into place and measure the wingtip-to-tail distance again; if both measurements are still the same, gently push down on the wing's center TE. The bolts will form small dents in the wing's top surface, indicating the bolt-hole locations. Remove the wing from the fuselage and drill the holes with a ¼-inch drill bit. Enlarge the holes slightly if necessary so that the bolts will fit through the holes and thread easily into the blind nuts.

Once this has been done, the plywood support plates can be glued to the bottom of the wing. Simply slip the bolt into the predrilled hole in each plate and screw the bolts into place. Trim the plates as necessary, and then glue them to the wing. This will give you perfect hole alignment.

INSTALLING THE TAIL

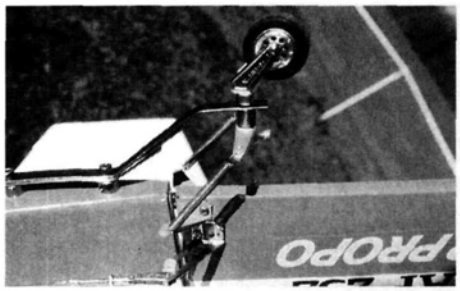
There is nothing difficult about gluing the tail feathers to the fuselage. The fin and stab fit precisely into the slots, and on my model, the fin was tilted just slightly to the left. I sanded the fin base until it fit properly and vertically into place. The horizontal stab required no trimming to align properly with the wing. To ease the installation of the horizontal stab, I cut the end of the slot free of the tail post so the slot would open up slightly. After I placed the stab in the slot, I clamped the end of the slot shut again and wiped away the excess epoxy that had squeezed out of the assembly. Once the fin and stab were glued into place, I installed the rudder and elevator halves and glued their hinges into place.

I did not use the wire tailwheel assembly that came with the kit. I used a leaf-spring assembly that I bolted to the bottom of the fuselage. Its installation required a plywood backup plate to be added inside the fuselage, and I installed this by cutting open the covering over the aft, bottom lightening hole. To hold the tailwheel assembly in place, I used two 4-40 bolts and blind nuts installed in the backup plate. The tiller arm is attached to the rudder with small springs.

If you use the stock tailwheel assembly, you will first have to install it in the fuselage tail post before attaching the rudder. The instructions show this in detail.

THE LANDING GEAR

Holes are already provided in the fuselage bottom for the bolt-on landing gear. I was



I used a leaf-spring tailwheel assembly to dress up the CAP's looks; easy modification.

FLIGHT PERFORMANCE

The Hangar 9 CAP 232 first took flight on a windy November morning. The Saito 1.50 started easily, and the takeoff run was only about 40 feet long. The wind conditions were so bumpy that no real evaluation could be made, but the model did show itself to be a good, stable and predictable performer. It was so windy, in fact, that the model flipped over on its back when we tried to taxi back to the pit area. Scratch one 16x8 prop! The next day's weather was perfect, and we were able to put the CAP through all of its paces.

• TAKEOFF AND LANDING

With its exceptionally long rudder, the CAP is undemanding and a pleasure to fly off the ground. Once you bring the throttle up to full, the tail comes up almost immediately, and little rudder correction is needed to keep the model straight. As speed builds, the model remains firmly on the ground until you apply a slight bit of up-elevator. With elevator set at low rate (1⅛ inch up and down), the model is very comfortable in pitch control. The Saito 1.50 allows takeoff and climb to altitude with only about ½ throttle.

Landings are "by the book" and again, are undemanding. The CAP has exceptionally good pitch control. Set up your final approach and come in with about ¼ throttle. If you do not pull enough up-elevator and fully stall the wing, the model will float some after flaring. For a tail-dragger, the rollout is easy and there's little—if any—tendency to ground loop.

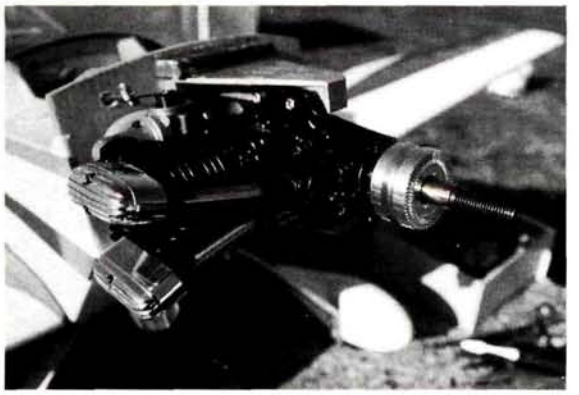
• GENERAL FLIGHT PERFORMANCE

Set up with the instruction's control throws, the CAP is sensitive to control inputs. For my style of flying, I preferred to use the low rate recommendations for high rate, and I reduced those throws by 40 percent for my low-rate settings. On the recommended high-rate settings, I found that the model would snap out of a loop when full up-elevator was applied. Since I have no experience in 3D aerobatics, I cannot comment on those control settings. I am sure, however, that the ride would be wild!

• AEROBATICS

Designed by Dave Patrick, the CAP 232 does every trick in the book and looks and feels good doing them. The model performs all the maneuvers with authority. Loops are big and flow smoothly, while rolls are very near axial. Four-point rolls require only slight rudder inputs to hold a straight line. Inverted flight is easy with a very slight amount of down required, and knife-edge showed just a hint of pitch coupling. This was so slight that I did not bother programming it out with my computer radio; but then again, I am a sport flier.

The minimal time you'll spend assembling this model, coupled with its high quality, makes the Hangar 9 CAP 232 a scale aerobatic dream come true.



A Saito 1.50GK powers the CAP 232 nicely. It fits almost completely within the engine cowl.

very pleased to find that the model has an aluminum L-angle bolted to a former to strengthen the landing-gear attachment. The bolts that hold the gear in place pass though the horizontal side of the L-bracket, and the vertical portion is bolted to the plywood former.

The wheel pants are held to the landing gear with an inner plywood plate and a small bolt that goes through the gear leg. I installed a 4-40 blind nut in this plywood plate for easier installation and removal of the pants. The stock setup uses a hex nut to secure the bolt, and I found it difficult to hold the small nut in place while tightening the bolt. The axle rod is also a thin bolt that's secured with a couple of hex nuts. The setup works fine, but I prefer to replace the bolts with Du-Bro screw-on metal axles.

POWERPLANT

Two slotted, aluminum engine mounts are provided with the kit. The slotted design allows you to easily slide the engine forward or aft to properly position it for alignment with the engine cowl. I found that the proper distance from the firewall to the back of the spinner is 6⅛ inches. I did not use the supplied Phillips-head bolts to mount the engine; instead, I used Du-Bro 6-32 cap-head screws and lock washers.

Fuel-tank installation is very easy, since the top of the tank compartment is open and is covered by the rather long engine cowl. Though several onlookers have voiced concern over whether the firewall is sufficiently strong without modification, I have found after several flights that it is quite strong enough, even with a Saito 1.50 bolted to it. For throttle control, I replaced the stiff metal pushrod with a Sullivan throttle cable. The engine cowl is attached to the fuselage with four 4-40 screws and blind nuts. I found it very easy to position the cowl after I had installed a 3-inch Tru-Turn* spinner and placed 3/32-inch shims between the cowl face and the spinner backplate. To make igniting the glow plug safer and easier, I installed a McDaniel* remote glow igniter and positioned it just aft of the engine cowl, between the landing-gear legs.

RADIO AND FINAL ASSEMBLY

I used a JR* 8103 radio with NES-4131 servos on the rudder and elevator, and NES-531s on the ailerons and throttle. I used a 5-cell, 1,100mAh battery pack to power the radio and secured it to the top of the fuel tank with Velcro®-brand fastener.

The elevator uses a simple, Y-end pushrod while the rudder uses a pull/pull cable system. I was very pleased with the way the rudder pull/pull system went together; it uses Sullivan clevises and threaded couplers, and thin music wire is used in place of the typical threaded metal cable. This material (supplied in the kit) solders very easily, and it took less than an hour to make up the entire system.

I used the control throws shown in the instructions, but I recommend that you use the low-rate settings during your first outing. The control throw recommendations are:

	LOW RATE
Ailerons	½ in. up 7/16 in. down
Elevator	1⅛ in. up/down
Rudder	3 in. left/right

	HIGH RATE
Ailerons	¾ in. up (same for 3D) ⅝ in. down (same for 3D)
Elevator	1¾ in. up/down (4 in. up/down for 3D)
Rudder	4½ in. left/right (same for 3D)

For those who would like to fly 3D manuevers, the CAP 232 has double-beveled control surfaces (elevator-rudder), so no modifications are necessary to achieve the 3D throw settings. I could not fly the model comfortably at the 3D settings.

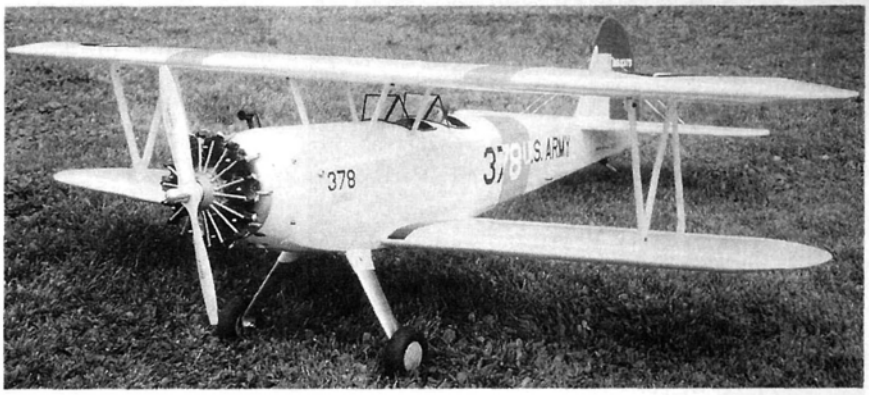
Once I had completely assembled the model, I balanced it inverted on a Great Planes* CG Machine. The recommended 5⅝ inches back from the LE of the wing at the fuselage side has proven right on for my style of flying. To achieve this position, I had to add 11 ounces of lead to the nose; not bad at all, considering the size of the IMAA-legal aerobat.

If you find yourself without the time to build a big, impressive aerobatic machine, consider the Hangar 9 CAP 232; I think you'll find that ARFs have come a long, long way.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ✦

Expose those engine cylinders!

by Richard La Porte



PHOTOS BY RICHARD LA PORTE

Securely mount a Williams Bros. dummy radial

When I decided to bash a Sig* Hog Bipe into a Stearman, I had one difficulty to overcome. How could I duplicate the exposed radial engine that's so characteristic of this beautiful aircraft? In 10 years of modeling, I had never read anything on how this could be done effectively.

Williams Bros. scale Wasp engine kit. The rear of the engine housing is left unfinished.

After analyzing the problem, I concluded that it had to be attacked in two steps: I had to build the dummy radial and fit it to the actual engine, then make a cowl between the firewall and the rear of the dummy radial.

ENGINE CONSTRUCTION

I used the Williams Bros.* Wasp scale kit for the dummy engine. It has nine cylinders instead of the seven usually found on Stearmans, but the diameter was about right for my model.

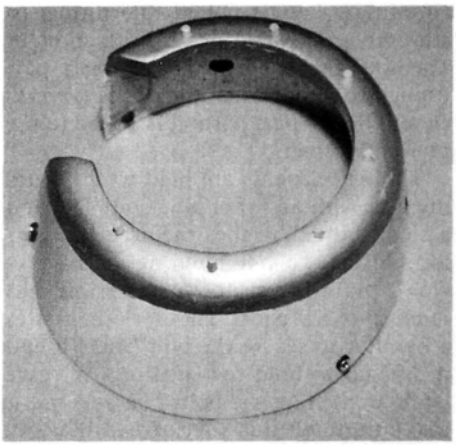
I didn't build the rear of the engine and left off everything aft of the intake manifold. After experimenting with various glues, I found that medium CA with a bit of kicker worked better than anything else on the plastic.

When the front of the dummy radial was complete, I mounted it on an O.S.* .70 4-stroke and trimmed it until it fit properly at the prop shaft. I had to cut two cylinder heads away about 50 percent to provide an ⅛-inch clearance between the dummy and the actual engine.

I carefully measured and recorded the distance between the firewall and the dummy radial's intake manifolds. This determines the length of the cowl.

COWL CONSTRUCTION

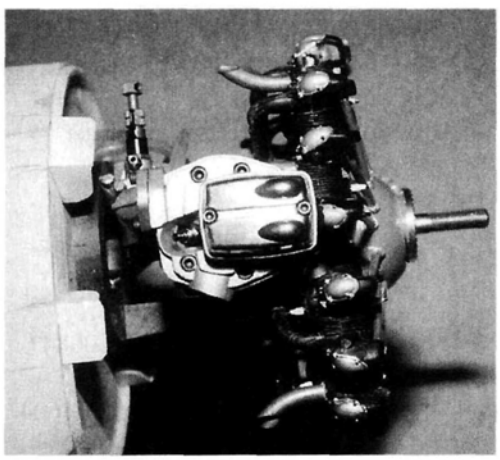
I removed the O.S. .70 and the dummy, then I installed a jig on the engine mount to represent the real engine and provide a centerline for the cowl. I slid a round template of the same diameter as the dummy onto the dowel of the jig, making sure it was the correct distance from the firewall.

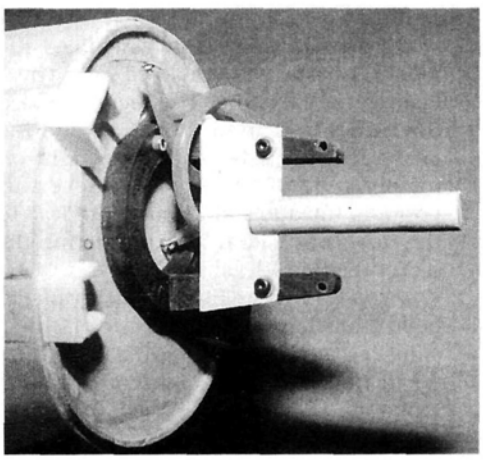


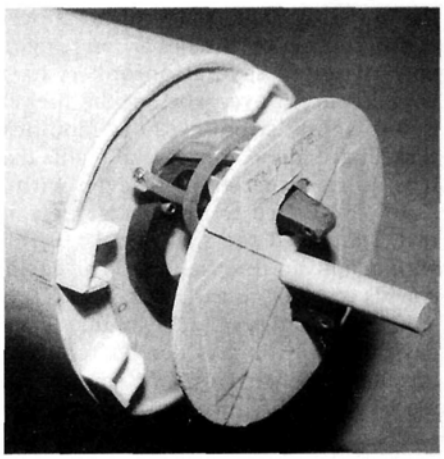
The fiberglassed cowl is ready to accept the dummy engine.

Using the template as a guide, I made the cowl out of a ½-inch-diameter balsa ring surrounded by 1/64-inch-thick aircraft plywood. I epoxied light fiberglass onto the outside of the plywood for strength and installed short sections of ⅛-inch dowel through the balsa ring. These dowels were later mated to holes in each intake manifold and hold the dummy radial on the cowl.

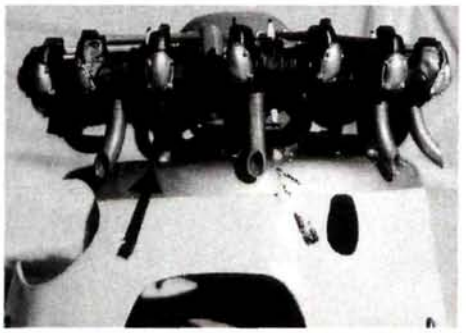
I then fit the cowl to the O.S. .70 engine and muffler and drilled a hole for the high-speed needle valve. When the fit-







Left: the dummy engine is fitted to the O.S. .70 4-stroke. Center: this jig is used to maintain the centerline. Right: this round template is used to guide cowl construction.



The dummy engine is attached to the cowl via holes drilled in each plastic intake manifold.

ting had been completed, I painted the cowl silver at the front and covered it with MonoKote* at the rear. I also drilled four mounting holes.

I attached the dummy radial to the cowl with PFM* because it helps to damp vibration. A separate piece of the cowl is permanently attached to the area just aft of the O.S. .70 cylinder head. It remains in place whenever the cowl and dummy radial are removed.

The right side of the cowl showing the permanently installed section behind the O.S. engine.

AT THE FIELD

During 25 flights, I have only been bothered by one problem: the two dummy cylinders that I had cut away to fit around the O.S. .70 kept falling off. I eventually ran dowels to each cylinder from the cowl ring. I installed the dowels at an angle and anchored them to the rear of the half cylinders with PFM. After I had completed this modification, the assembly held together very well—even during a few nose-overs on landing! The dummy radial looks great and really makes this model stand out.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

A fine day at the field guaranteed!

by Chris Chianelli

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

Flying R/C airplanes for 28 years has taught me two most important rules for staying happily enthusiastic about this hobby. First, always try new things to keep it fresh and exciting. Second, always keep a rock-solid flying airplane ready to go in the hangar in case that "fresh and exciting" project decides to do a wingtip dance into oblivion.

Crashes are all part of it, but they're a lot easier to laugh off if you always have a ready-to-go backup model on which you can depend to deliver some relaxed flying and a full day's fun at the field. What a great feeling that is.

In the old days, such confidence-building, fly-'em-every-day-type models were usually nondescript sport designs of the Ugly Stik ilk. Thanks to Great Planes*, today, every modeler can have a gorgeous ¼-scale Spacewalker as his very own easy flier in just a few evenings' worth of building. Moreover, not only is this model a well-finished and accurately built ARF, but it can also be legally flown at any IMAA scale meet! Some might disagree, but in my opinion, the hobby certainly has changed for the better over the years.

The first thing you need to know is that this 79-inch-wingspan ARF is 100-percent built of balsa and plywood and brightly covered with yellow and red MonoKote. The model looks as if someone really built it up in their shop. That's because someone did! The difference is, the shop this model was built in is way bigger than yours or mine—referred to by normal people as "a factory."

Great Planes Spacewalker

THE "KIT"

The Spacewalker box is filled with hardware and accessories that most modelers will find up to the task, including wheels, adjustable engine mount, tank and spinner. While all hardware and accessories served their function well, I like the model so much I think it deserves an aluminum spinner in place of the stock plastic unit. The same goes for the engine mount. I've never cared for fiber-filled resin mounts and prefer aluminum beam mounts. This is a personal call, and I do tend to be a bit of an "old-timer" when it comes to engines and their support gear. One other note concerning the hardware: if you do intend to do the IMAA circuit with the Spacewalker, you might want to upgrade the 2-56 pushrods, clevises and control horns with 4-40-size units, as technically, this larger size is required by IMAA rules. Although I feel the supplied hardware is more than sufficient for this design, considering the 9.49 pounds of flying weight and 20 ounces of wing loading, sooner or later, you will run into an IMAA event safety director who will make an issue of it.

The cowl, wheel pants and wingtips are all of vacuum-formed ABS plastic. I did reinforce the cowl at the screw hold-down points with extra Celastic that was supplied in the kit, and to this day, it shows no sign of cracking. (I've been informed by Great Planes that the cowl now comes reinforced with fiberglass.) Like the cowl, the wheel pants were also well formed with thick plastic and never cracked. The wingtips, however, are formed a bit too thin and did crack too easily on the first day of flying.

The main sub-assemblies of the Spacewalker—the fuselage, the wing halves and the tail feathers—are constructed of good- to excellent-quality balsa and plywood parts that are brought together with a high degree of craftsmanship. Just to give you an idea of the thought that has gone into this ARF: even the pull-through strings for pulling the aileron servo wires from the wing center section to the servo bays are already in place.

CONSTRUCTION

The word "construction" is totally inappropriate to use in conjunction with this model. The term "enjoyable assembly" is far more fitting. With the 24-page instruction manual and the 65 photos and diagrams found therein, it would be a waste of your time and our magazine space to walk you through a step-by-step building process here. Other than one area where I opted for a different method from the manual and one place I felt the sequence could have been better, I could never top the superlative job Great Planes has done

SPECIFICATIONS

Model: Spacewalker

Manufacturer: Great Planes

Type: ¼-scale

Wingspan: 70 in.

Wing area: 1,096 sq. in.

Weight: 9.49 lb.

Wing loading: 19.97 oz./sq. ft.

Engine req'd: .61 to .75 2-stroke, or .70 to .91 4-stroke

Engine used: O.S. FS-91 Surpass w/pump

Radio req'd: 4-channel with 5 servos (throttle, rudder, elevator and two for ailerons)

Street price: $270

Features: all-balsa-and-plywood ARF covered with MonoKote; all surfaces pre-slotted for hinges; comes with complete hardware package, spinner, tank, wheels and adjustable fiber-filled engine mount.

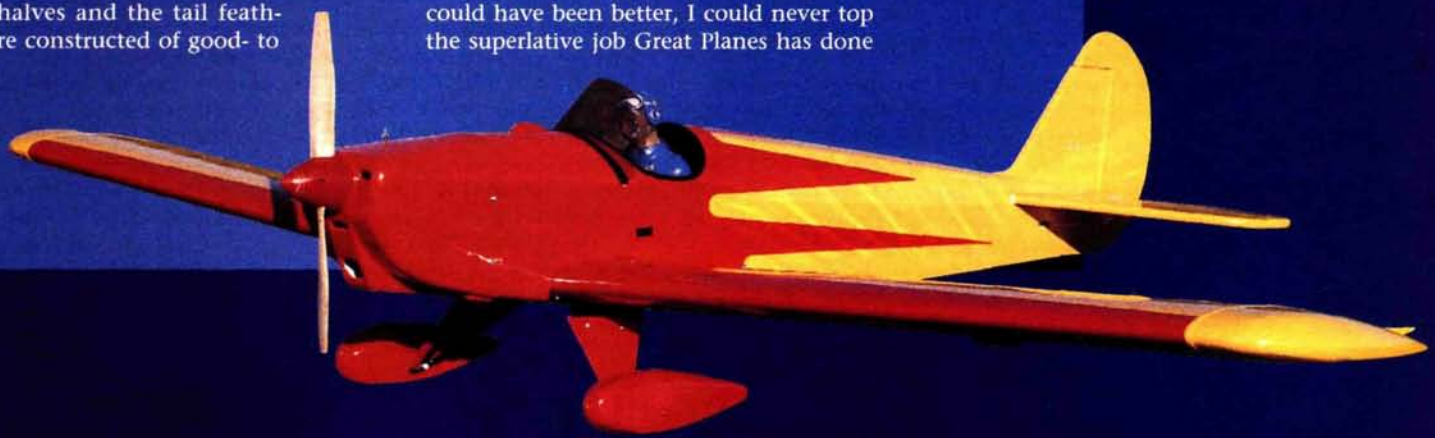
Comments: fantastic flight envelope that ranges from docile to very aerobatic, depending on control-surface deflection. Large size and bright colors make it easy to see in flight.

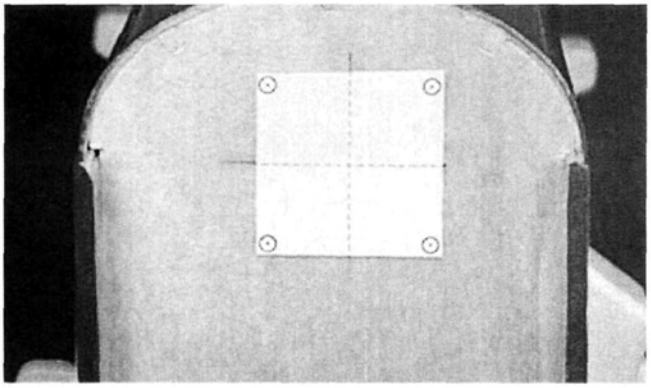
Hits

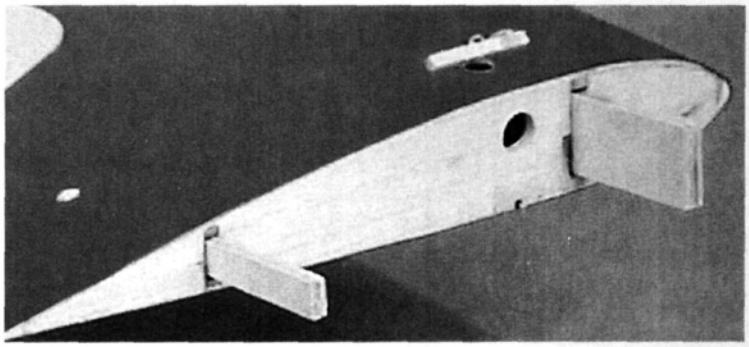
- Good workmanship.
- Excellent flight performance.
- Beautiful ¼-scale appearance.
- Striking presence in the air.
- Good instructions.

Misses

- Wingtip plastic too thin.
- One construction step out of sequence (see text).

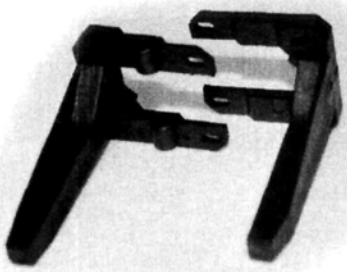






The forward and aft plywood joiners needed only the slightest sanding for a perfect fit. The entire kit features this type of precise parts fit. Note: aileron servo wire pull-through string is already in place and tied off through a hole in the wing's upper sheeting.

Above: this motor-mount drilling template is cut from the instruction booklet and tack-glued to the firewall. It really helps alignment and reduces the possibility of error during motor-mount installation. Right: my preference is aluminum, but the supplied glass-filled adjustable mount works OK and is extremely convenient to use.



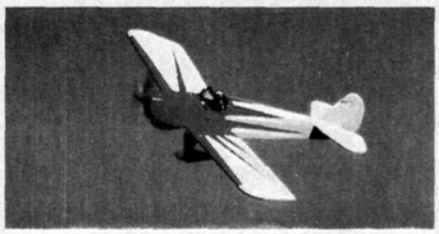
on the instruction booklet. So what would be the point?

The area where my personal preference won out over the instruction recommendations was with the radio installation. With .90-size and larger models, I like to run each elevator half with its own servo and Y-harness them to the receiver the same as is done with the ailerons. About 15 years ago, I had an elevator-servo failure on my 1/3-scale Christen Eagle. As luck would have it, I had each half of the elevator powered by its own servo, and the elevator half that remained functioning was sufficient to nurse the Eagle back for a reasonably uneventful

FLIGHT PERFORMANCE

I found myself at the field with my *Model Airplane News* associates Larry Marshall and Gerry Yarrish. When I announced the wing loading, everyone wanted a turn at the controls. It was a sunny, cool, dry day—the best for flying alcohol-powered models! The wing gets optimum lift from that cool dense air and the engines optimum power from low humidity. Since we're all experienced pilots, I set up all surfaces for maximum suggested throw.

With the long tail moment and wide-track main gear, ground handling is excellent. While the included 2½-inch wheels and axle location (about ¼ inch behind the leading edge of the wing) might prove slightly problematic on rougher grass fields, I managed on our average surface grass field just fine as long as I kept full up-elevator when taxing upwind and full down-elevator when taxing downwind.



Again, with the long tail moment, take-off runs are very predictable and easy to control with this tail-dragger. Straight-ahead rollouts are easily maintained, and all controls exhibited positive characteristics right from ground-break throughout a flat climb-out.

I know this might come off sounding clichéd, but the Spacewalker really did fly right off the board, needing only slight down-trim and right rudder trim at the transmitter. No adjustments to the model's control linkages were needed. The wing saddle, stab saddle, fin slot and firewall are so accurately machined and assembled with this model that providing proper time is taken with all wing, stab and fin alignments and measurements as prescribed in the instructions, the model just has to fly true from the start.

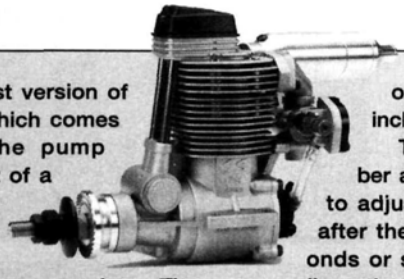
After a few high-altitude figure-8s to make sure all was definitely well, it was down on the deck with some slow flybys. With its large size, bright colors and smooth response, the Spacewalker is a super confidence builder. Even with the slight gustiness that had set in with the onset of noon, landing setup and final approaches were rock solid, and the glide sink rate is comfortably shallow. With a 20-ounce wing loading on a model of this size, this should really come as no surprise. With the throws set at minimum, I'm convinced a young fledgling with good reflexes could learn to fly with this model—no problem.

As predictable as it is, the Spacewalker did hold a surprise: when the O.S. was leaned out a bit, it was time for some aerobatic barnstorming. Despite all its inherent stability, the Spacewalker would perform stall maneuvers whenever asked. Spins and snap-rolls are part of the Spacewalker's capabilities. If it's balanced even a bit nose-heavy, however, I'm sure this characteristic would disappear instantly. Mine was balanced exactly as per instructions. Another testament to the craftsmanship Great Planes put into this model is how little down input was required during inverted flight. To achieve this, great accuracy must be maintained with things like wing and stabilizer saddle machining. Personally, I like to fly my models with a bit of down-trim. I've always done this. It just makes a model feel more "groovy" to me. So when I flipped the Spacewalker onto its back, no down input was required at all during level inverted flight. This can mean only one thing: wing and stab incidence are dead on. End of story. Oh, yea; you can add engine thrust to that also, which obviously relies on proper firewall installation. You want further evidence? Rolls were very axial, needing only slight elevator correction.

Graceful Cuban-8s, hammerheads, stall turns and the like are all for the asking with this 79-inch-wingspan bird. Of course, close in and low are what do it for me, and this big bright beauty is perfect for that kind of adrenaline-producing fun.

Right from the first flight, the Spacewalker was very relaxing to fly during the entire session—a total joy; well, except for one annoyance: Gerry Yarrish could do better-looking snap rolls than me. While Great Planes does state a maximum power of .91 4-stroke—and, rest assured, the O.S. did a fine job—in my opinion, the airframe of the Spacewalker is big enough and easily strong enough for a good sport 1.20 4-stroke. Then it would be flying-circus time!

O.S. FS .91

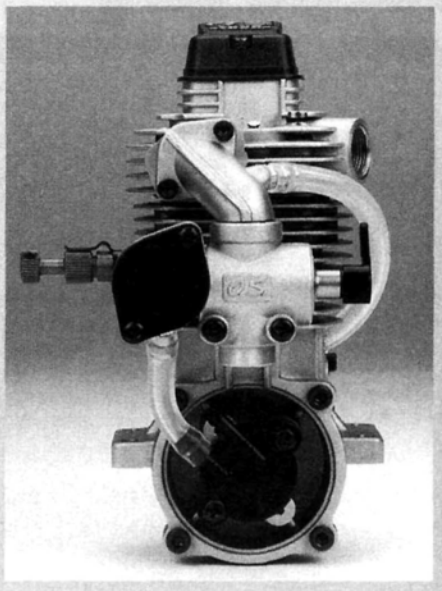


This is O.S.'s latest version of its 4-stroke .91, which comes with a pump. The pump mechanics consist of a diaphragm-type pumping unit in the back plate position and a pressure regulator. The pump feeds the pressure regulator, which is on the carburetor body. The black cover houses the regulator mechanics.

This latest style of O.S. pump is the simplest and easiest to use thus far. After I ran three 12-ounce tanks of fuel through the engine on the bench (15 percent nitro and 18 percent oil—mix of synthetic and castor) using an APC 13x6, I installed the engine on the Spacewalker. During the entire day's flying, the .91 never faltered, and it idled between 2,500 and 2,600rpm on a Zinger 14x8 and using the included O.S. "F" plug.

The important thing to remember about this engine is not to try to adjust the high-end needle until after the engine has run for 30 seconds or so at about ½ throttle. This allows the proper pressure to build up in the regulator. Then, and only then, can the high end be adjusted. Follow this procedure every time, and your O.S. FS .91 will run like a Swiss watch, as did mine. And of course, read and follow all the instructions to the letter.

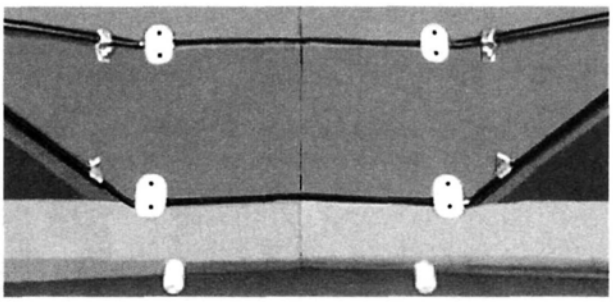
Although I did get a reading of 8,600 on the 14x8, I felt at the time that the engine was still too new to get optimum high-end readings on other props. I will revisit this engine in an upcoming "Air Power" column.



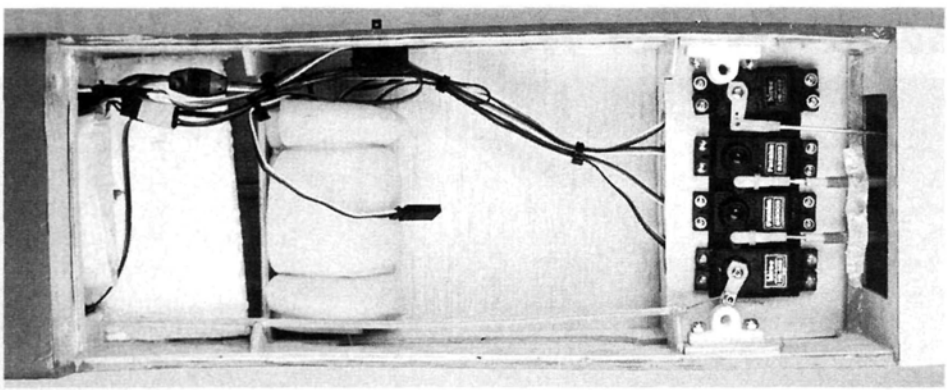
landing. Ever since, I've opted for two-servo systems on both ailerons and elevator.

My only other departure from the instructions was the sequence for installing the landing-gear fairings. The instructions would have you install the fairings before mounting the main gear to the wing. I recommend doing it the other way around. The distance between the two pieces of music wire that make up the gear changes when they are placed in their respective landing-gear blocks. They have to be spread apart to fit in the blocks. Obviously, if you drill the holes for the fairing first, you're going to have to redrill for a wider spread when you attempt to install the gear on the wing. Install the fairings *after* the gear has been mounted on the wing. Other than that, I followed the instructions to the letter, took my sweet time when taking measurements to square up the wing to the fuselage and the stabilizer to the wing and was rewarded with a scale beauty that flies straight as an arrow.

Contrary to the instructions, the landing-gear fairings (right) should be installed after the landing gear has been installed on the wing. This is because the gear wires must be spread apart to fit in the blocks (below), and this will change where the holes need to be drilled in the fairings .



The specifications say the finished model will come out to between 8 and 8.75 pounds, depending on the engine used. I found this figure dubious, considering the size of the craft. Using O.S.'s* latest pumped FS .91 4-stroke, my model weighed 9.49 pounds, including the 6 ounces of nose weight needed for proper CG location. This weight is still excellent for the model's wing area and gives forth a fantastic wing loading of only 19.97 ounces/square foot.



As you can see, the radio compartment is cavernous. The two center servos independently drive the elevator halves. See text.

CONCLUSION

I really wish there were more ARFs in this size. When a model's wingspan approaches the 6-foot mark, it really starts to fly on the wing—very scale-like, yet you can still get it in the car!

With its fantastic flight envelope, the Spacewalker has to be one of the most versatile models around. Intermediate to advanced pilots alike would do well having one in their stable. No longer does that backup model have to be a generic ugly duckling. It can be a well-made, ¼-scale, gorgeous Spacewalker. I'm already picturing how gorgeous mine is going to look on floats!

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

by Randy Randolph

PICA INC.

P-51

For many years, very few .10-size airplane kits were available. Thankfully, that fact has changed, and manufacturers are once again looking to small, inexpensive airplanes. The influx of new .049- to .15-size engines is partially responsible, as is the fairly recent introduction of events such as 1/12-scale R/C combat. Although Pica* does not specify that its 1/12-scale P-51 is intended for R/C combat, there is no question that it would be ideal!

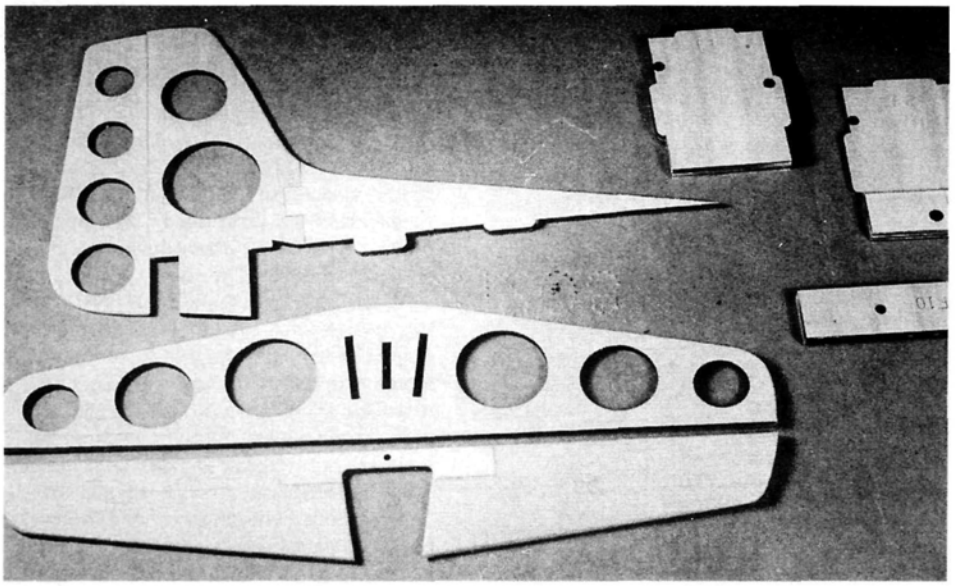
A 1/12-scale fighter that's easy to build

When I opened the P-51 kit box, my first thought was that these people are proud of their work. The more fragile parts were wrapped in tissue and nested so they would survive shipping without being damaged. There were two complete hardware packages—one for the control linkages and the other for the landing gear and its mount. The wood had been selected for the job it was to do, and the laser cutting was as good as I have seen. Actually, the parts fall out of the balsa as well as the plywood. Luckily, the parts were labeled because it would have been a chore to match them to the plan numbers. The instruction sheets use a "check-the-box" sequence of assembly, with sketches accompanying steps that might need a little more clarification. The entire fuselage top is molded out of clear plastic.

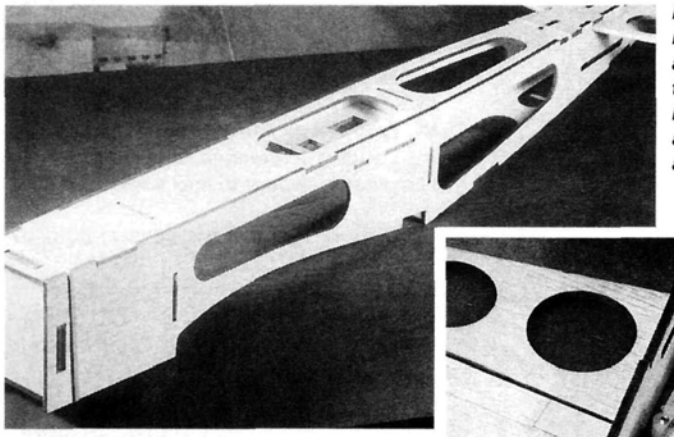
CONSTRUCTION

The first items you construct are the fin and rudder and the stabilizer and elevator. Building these is like putting together interlocking jigsaw puzzles with big parts. It is easy and results in surfaces that are accurate, with the wood grain running in the right direction. After assembly, they are sanded, beveled along the hinge line and covered. You have to cover the tail surfaces at this point because they are built into the fuselage as it is assembled, and covering them later would be very difficult. The covering material forms the hinge on both elevator and rudder (a system I like and have used many times over the years).

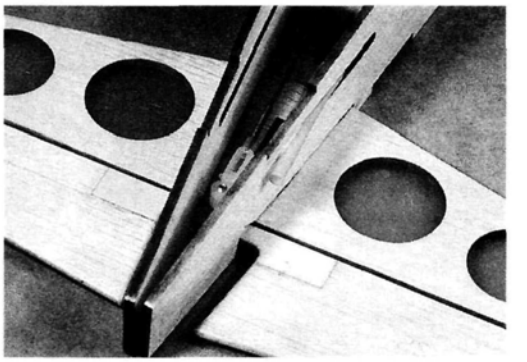
The fuselage and wing structures are



The tail surfaces are notched together with the grain of the wood running in the proper direction to provide strength without adding weight. Laser-cutting makes for beautiful plywood parts.



Left: the fuselage sides are notched to the top pieces as well as to the bulkheads to form a very true assembly. Rubber bands hold it all together so glue can be applied.



Right: the rudder pushrod exits the fuselage side while the elevator pushrod is internal; neat installation.

SPECIFICATIONS

Model: P-51

Type: 1/12-scale

Manufacturer: Pica

Wingspan: 36 in.

Wing area: 220 sq. in.

Fuselage length: 27 in.

Engine rec'd: .061 to .10ci

Engine used: Norvel .061

Radio req'd: 3- to 4-channel

Total weight: 24 oz.

Wing loading: 15.7 oz./sq. ft.

Price: $69.95

Features: laser-cut, labeled balsa and plywood parts; control-linkage and landing-gear hardware; instruction sheets and sketches; molded/clear plastic fuselage top.

Comments: while not the most accurate reproduction of a P-51, the Pica model is close enough to satisfy the needs of R/C combatants and just about all others who do not consider themselves purists. The kit parts go together accurately and fast enough for the builder to retain interest in the project. When completed, the P-51 flies well enough to satisfy just about anyone.

Hits

- Well-engineered construction.
- Excellent parts fit.
- Illustrated step-by-step construction manual.
- Good flying airplane.

Misses

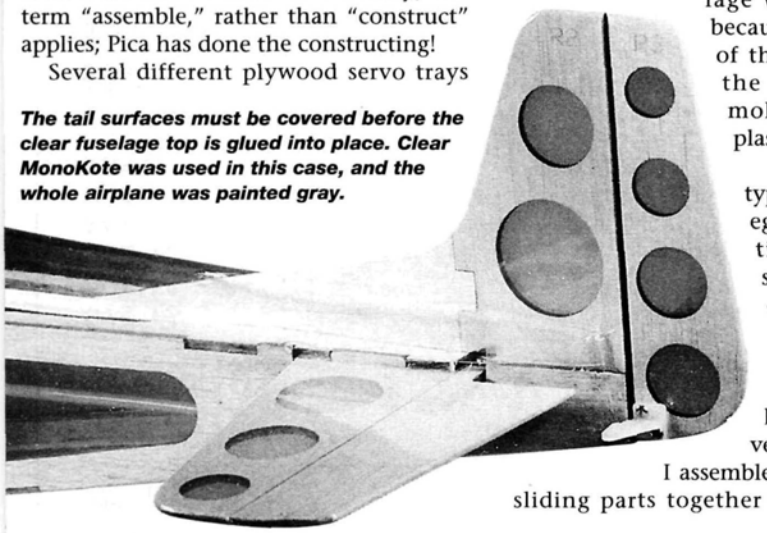
- Poor landing gear and placement.
- Poor scale appearance of cowl to spinner match.

[Editor's note: Pica has redesigned the landing-gear placement on subsequent kits.]

really well-engineered. After I had glued a few formers and the servo mount to one fuselage side, the other side slipped into place and was aligned perfectly with the first in all respects. Fitting the top and bottom sheeting went so smoothly that the basic structure was finished before I knew it. Actually, the term "assemble," rather than "construct" applies; Pica has done the constructing!

Several different plywood servo trays are provided and because you build them in as you go, you have to choose and drill the one that matches your servos. After the fuel tank has been installed and the firewall drilled, most of the fuselage work is finished because the entire top of the fuselage above the thrust line is molded out of clear plastic.

The tail surfaces must be covered before the clear fuselage top is glued into place. Clear MonoKote was used in this case, and the whole airplane was painted gray.



The wing uses a type of interlocking egg-crate construction. That may sound complicated, but it went together slick as a whistle! This is the first wing I have built in a very long time that I assembled by slipping and sliding parts together in the air rather than over a plan. The main spar is made out of laser-cut halves that are joined by a plywood joiner. The ribs are slipped into a laser-cut leading edge (LE) web; then the spar is slipped into the rib spar notches. The whole works are locked together with tabs and notches. The wingtips and the leading and trailing edges (TE) are added to complete the main wing structure. I would have bet that the finished product would look like a snake when finished, but it didn't; it was right on the money!

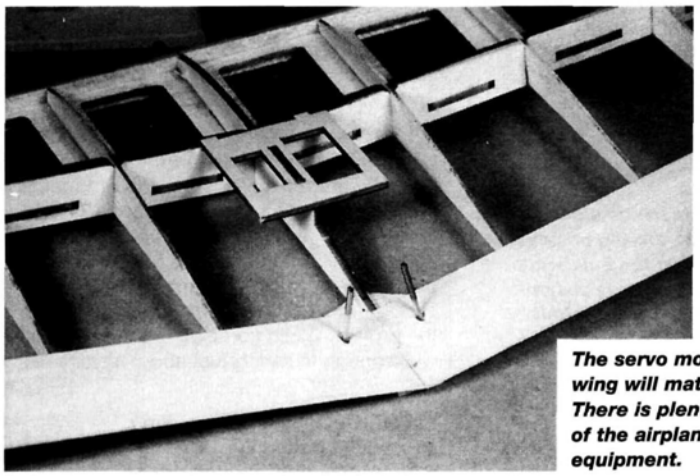
I had to remove a lot of material from the LE to blend it into the ribs. I used a razor plane for this job, and it made things much easier. A sanding block finished the job on the LE as well as the TE and wingtips. I followed the instructions to the letter, and the aileron installation was as smooth as silk. The ailerons need a groove about 4 inches long to match the aileron torque rod. A tool made out of a piece of 1/16-inch wire ground flat on one end makes short work of this small task.

After it has been sanded, the wing is ready to cover. Before covering and finish-

After it has been sanded, the wing is ready to cover. Before covering and finishing the fuselage, the tail group must be covered and glued into place. The clear fuselage top is then fitted and glued into place, so the covering material helps anchor it to the rest of the fuselage. Instead of covering the airplane with gray MonoKote* and painting the clear fuselage top with matching paint, I covered it with clear MonoKote then painted the whole airplane, including the underfuselage radiators. It came out all right, but I think colored covering material and paint to match the fuselage top is really an easier way to go. I added the exhaust stacks, the insignia, the cowl, the wingtip trim and the black anti-glare panel.

I was disappointed in the landing gear and its location. On the full-scale P-51, the gear is almost on the LE of the wing and sticks well forward from there. The gear on this model is just in front of the main wing spar and is supposed to be bent forward to the proper position. Actually, it is too short to reach anywhere close to the proper place and looks rather skimpy. Hand-launching without the gear tends to grind off the radiators under the fuselage on every landing, but it sure looks better in the air.

There is plenty of room for a full-size radio, but the FMA* Fortress and S90 servos saved several ounces and worked beautifully. In fact, on the test flight the receiver antenna was trapped on the inside of the fuselage—luckily, without ill effect!



The servo mount in the center of the wing will match two sizes of servos. There is plenty of room in the inside of the airplane for all radio equipment.

FLIGHT PERFORMANCE

The first flight found me behind the airplane for the first few seconds. Because it doesn't have a tailwheel, it took some rudder walking to keep the model on the runway and the prop out of the asphalt. Also, it was faster than I had expected and got rather small in a hurry.

When balanced at the spot shown on the plans, the model is stable and responds very predictably to all control inputs. It is a pleasure to fly. At full power, it will do nice, smooth, axial rolls and nice, round loops. Snap rolls and stall turns are pretty quick and can be done at full throttle from a nose-up attitude. There's some warning before the stall, but not a lot, and spins require a little time to recover after you input corrective control. Level flight can be maintained at a little more than ½ throttle, but the plane is not really comfortable in that mode. Landings are a little hotter than those with a trainer and are best handled with enough power to fly all the way to the runway. Wheel landings are nice, but stay away from any forward stick on rollout, or the prop will go into the ground! I haven't tried adding a streamer, but a .09 to .10 has plenty of power to haul it with ease.

*Addresses are listed alphabetically in the Index of Manufacturers on page 134.

Send in your event coverage. Mail photos, captions and text (500 words or less) to "Grassroots," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Color slides and prints are acceptable.

Warbirds over Washougal

At the annual Warbirds over Washougal scale fly-in and airplane wash at the Fern Prairie Modelers field in Washougal, WA, we didn't get rained out, but we certainly got rained on. Washougal is at the western end of the Columbia River Gorge, a very scenic part of the state that also boasts some unusual weather.

Bob Robinson brought this 68-inch-span Vickers Wellington. It's powered by two O.S. FS .20 4-strokes.

Vance Mosher built this 64-inch-span Grumman XF5F from Bob Holman plans and writes that it's a very realistic flier. It uses two ancient O.S. .40 4-strokes for power.

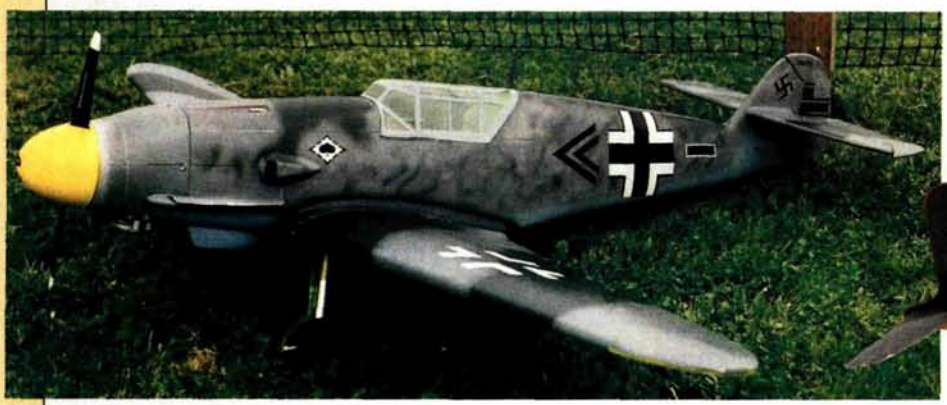
"Warbird Row."

About 15 fliers showed up, and their models, true to their military roots, were prepared to fly no matter what the weather. We had four twin-engine aircraft, including the very unusual Vickers Wellington and Grumman XF5F Skyrocket. The British nicknamed the Wellington "the Wimpy," after a character in the then very popular "Popeye" cartoon. It was an all-wood and fabric-covered medium bomber. The Skyrocket was Grumman's first try at a twin-engine, long-range fighter. It was superseded by the F7F Tigercat, with twice the horsepower. The model Skyrocket proved it could be safely flown and landed on one engine when a muffler fell off,

stopping the engine due to lack of fuel pressure.

We even had two Fieseler FI-156 Storchs! The green, 96-inch-wingspan model Storch is capable of wings-level figure-8s inside a 100-foot-diameter circle, and it will take off or land in about 20 feet. It's really interesting to watch that long landing gear lurch up on its tiptoes as the aircraft jumps into the air. This model has a scale folding-wing mechanism that cuts the flying-field assembly time down to about 3 or 4 minutes.

This much-modified Sureflite electric-powered P-39 is the handiwork of Jerry Holcomb.



Larry Smith's BF 109-G Messerschmitt has a 65-inch span and was built from an IMP kit.

Vance Mosher's Corsair on a low flyby. The 72-inch-span model is powered by a SuperTigre 2500 turning an 18x10 prop.

The Curtiss SC-1 Seahawk was a response to the floatplane version of the Zero, but it was never really used as a fighter. The very large (about 68-inch-span), light model was hand-launched with an underhand toss and was easily landed on the very wet runway. It flew beautifully, and I'm sure the original was not nearly as aerobatic.

The electric P-39 Aircobra was very realistic in the air and a joy to watch land. It is a converted foam Sureflite kit.

We didn't lose any airplanes, but several of the waterlogged pilots didn't make it all the way through. Those who did had a fine time, though, and we'll do it again next year.

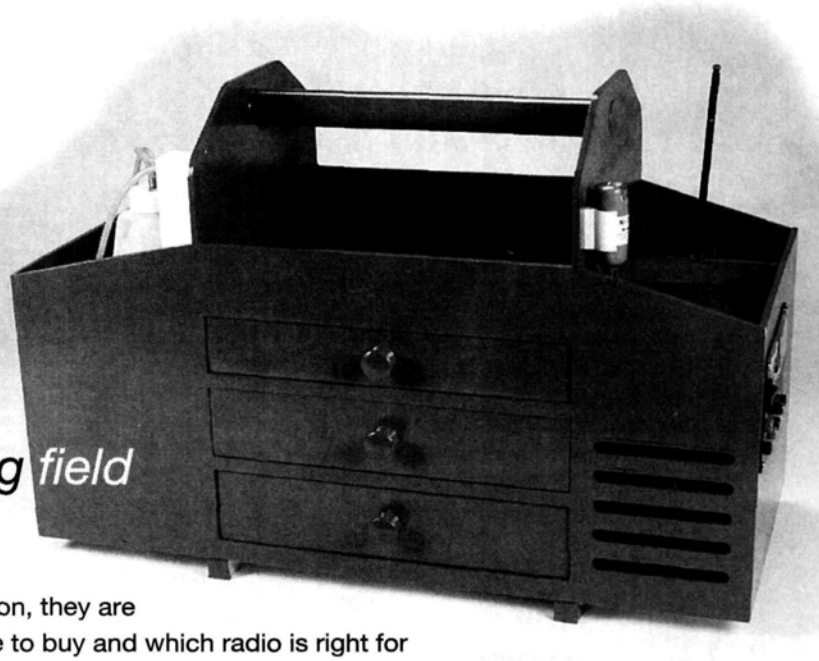
This scratch-built Curtiss SC-1 Seahawk was hand-launched and landed easily on the very wet grass. A SuperTigre .90 powers it.

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

Sig Fieldboss Flight Box

Organize yourself at the flying field

by Larry Marshall



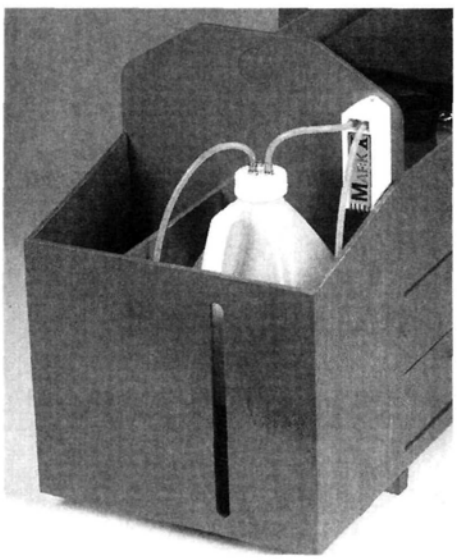
WHEN NEWCOMERS GET into model aviation, they are bombarded with advice about which plane to buy and which radio is right for them, and with information about engines, fuel, glow igniters and a host of other paraphernalia. What we don't talk about is the flight box that every modeler, sooner or later, needs to get all this stuff to the field. But if you ask many old-timers about their experiences with flight boxes, each will have opinions, and chances are, each has gone through several during their modeling careers.

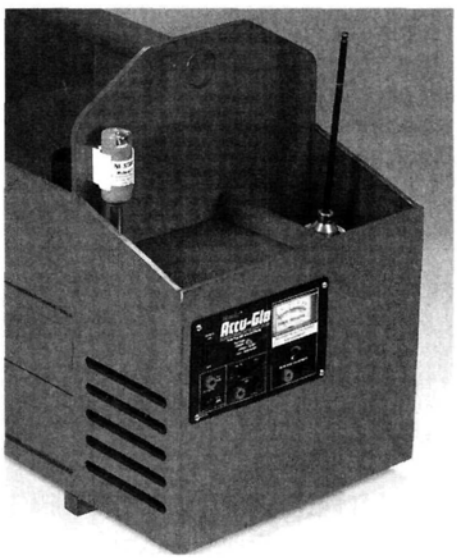
I'm no different in that regard; I've bought and built several, and I've even designed a few. Each has had its virtues, and my conclusion from all of this is that the ideal flight box weighs nothing, is the size of a loaf of bread and can hold all my tools, accessories, fuel and fix-it parts for every contingency that arises with my planes and those of my fellow fliers. Unfortunately, I've yet to find that sort of space-defying flight box, so the usual concession is to size. And that's exactly what the new Sig* Fieldboss flight box is. Larger than most commercial flight boxes (11x16½x24¾ inches), it provides lots of space for tools, props, battery and just about anything else you'd care to haul with you to the flying field. I really enjoy the roominess of the three-drawer setup. Each drawer is 10x11½ inches, and they vary in depth. I keep tools in one drawer, a bunch of small, clear plastic boxes of screws, servo wheels, clevises, etc., in the second, and stuff like fuel tubing, cable ties, tape and glue in the third. I also like the two deep chambers on each end of the box. On the fuel-bottle end, I keep a rag or two and some props; in the other, I store a voltmeter, my glow-igniter charger, and another small charger for charging radio gear. So far, I've been successful in keeping the top tray pretty much empty (I do keep a radio strap there); this works well, as I can drop parts onto it for safekeeping while I'm working on a plane.

The power panel area is neat, too, in that the battery goes into the chamber behind the panel, and the top of that chamber is simply a drop-in piece of wood that fits snugly but can easily be removed for battery removal. Just above this is a handy place to keep my McDaniel glow igniter. This location protects it from getting banged during transportation and yet it's readily available. I ran wires from this area, attached them to the "roof" above the top drawer and out to the pump I had placed in the fuel-bottle chamber. This works really well, and since I tapped power from the appropriate areas of my Hobbico power panel, I can use all the facility of the power panel to control the pump.

The best part about this new flight box, however, comes before you use it. As it falls out of the box, all the parts are very accurately laser-cut, making assembly a breeze. The wood is all high-quality, ¼-inch liteply. I used medium CA throughout, though epoxy would be a good (and cheaper) alternative. Everything fit beautifully, and I had the entire box, including all three drawers, constructed in a couple of hours. All of the parts use interlocking tabs and, thus, it's pretty impossible not to gain proper alignment. The one downside to this is that if you want these tab locations to disappear when you paint, you'll need to use some filler to smooth them over. A good coat of fuelproof paint, and you're off to the races.

The Fieldboss retails for $49.95, and if you want a bit more room for storage, I recommend that you give it a look; it gives you lots of space and compartmentalizes it well.





One end of the box houses fuel and accessories, while the other holds a power panel, battery and starter.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

HIROBO SHUTTLE CHALLENGE

by Larry Marshall

LAST SUMMER, I decided to learn how to fly helicopters. As is typical of my luck, the tool to do that was invented this year. The Shuttle Challenge from Hirobo* is truly a breakthrough in providing an easy way into helicopters. Don't let its appearance fool you; it is much more than just a Shuttle sitting on training gear. It has been designed with the newcomer completely in mind and does a great job of giving confidence to the newbie heli pilot during the early steps of flying. What intrigues me is its potential to help me learn nose-in flying.

This helicopter comes in kit and ARF versions. I chose the ARF because I think that's how new heli guys are going these days. ARFs eliminate some of the early learning curve, though I do think this is overstated sometimes, as assembling a Hirobo kit is a breeze. I also wanted to see if the concepts of "ARF" and "helicopter" really go together, as helicopter assembly requires attention to detail, and I wondered whether a mass-produced product could address those details. Frankly, I didn't think it could, but I was in for a surprise.

Much more than training gear

ASSEMBLY

As the helicopter comes fully assembled, there is very little to do. I went over the heli, checking all the frame screws for tightness and all the ball links for binding, and I checked the belt tension. To my surprise, I found only one screw that I wanted to tighten a bit more; all the ball links moved freely.

I installed five JR* 531 servos and, as something of a challenge to the Challenge, did nothing but hook up the ends of the control rods to the servo arms (the control rods were already connected to their output locations). I did not measure the control arms because I wanted to see how correct they were right out of the box. It turned out that they were much better than I ever expected, as indicated by the "rule of 90"; this states that controls should form 90-degree directional changes when set up properly, but the real test would come in the flying.

I tend to use 2-ounce header tanks on all my helis, but I didn't install one on the Challenge because I wanted to keep things as simple as possible, testing it more as a newcomer to the hobby. Besides, Hirobo includes a fuel filter in the fuel line which makes for a handy fueling location in a no muss/no fuss way. I did, however, install a McDaniel* remote glow plug, as I use a McDaniel glow igniter and I can't access the glow plug with it. If you use a short, power-panel glow igniter, you can access the plug by turning the helicopter on end, but I feel this $10 addition makes the starting procedure so much more user-friendly that it's just not worth it to scrimp here.

You must bolt the two landing-gear supports to the frame. There are also four pieces of hardware that must be bolted to the center piece of the gear. These receive the tapped ends of the long rods and act as the pivots for the gear as the helicopter lifts off the ground. The rods themselves are simply pushed through each of the gear struts and screwed onto the center piece. This is handy, as you can just as easily unscrew the rods for transportation.

I usually balance the blades, clutch assembly, flybar, etc., but again I wanted to check the ARF concept, and since all these parts come already assembled and on the helicopter, I just left them where they were.

One of the more time-consuming things about "building" a Challenge ARF is applying the graphics. But a cup of coffee and a pair of scissors made it a pleasant task and when finished, the result is worth the effort.

I set up a memory on my JR 8103 heli radio but decided to fly the Challenge initially with just the default pitch/throttle curves, thinking that this might be the first approach used by a newcomer. I had installed an Expert* EX-100 gyro, so I checked the direction of its response as well as those of the principal controls. I set the gain on the gyro fairly high, since I felt that this is how a trainer helicopter would be set up.

FLYING AND OPERATION

At this point, with the helicopter sitting on my shop bench in one piece, I realized that I had one "problem." I normally put a couple tanks of fuel through my engine before I ever put it into an aircraft. I could have pulled the engine out and done that, but that didn't seem to make much sense, so I took the machine into my front yard and fired it up.

The Challenge comes with a starting wand that you can stick handily into a standard electric starter cone. After fueling up, I turned over the engine a few cycles using the top start feature and then attached a glow igniter. Much to

SPECIFICATIONS

Model: Shuttle Challenge

Type: helicopter

Manufacturer: Hirobo

Distributor: Altech Marketing

Price: kit $299; ARF $499

Engine used: Enya .35

Radio req'd: 5-channel heli radio

Radio used: JR 8103 with five JR 531 servos

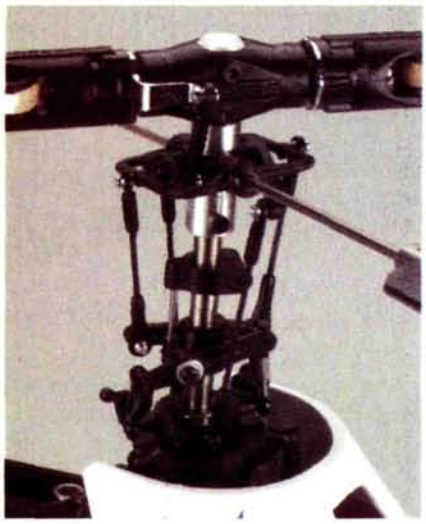
Features: landing gear specially designed to prevent crash damage on hard landings; head specially designed to prevent boom strikes; Hiller-biased see-saw arrangement and heavy flybar paddles to improve stability.

Comments: we have long needed a fail-safe way to learn how to fly helicopters. The Shuttle Challenge is it.

Hits
- Easy to build.
- Good setup instructions.
- Very stable to fly.
- Unique training-gear system.

Misses
- None.

You can lift the Shuttle Challenge fairly high off the ground before the gear lifts off.



my surprise, the engine started immediately. Even more surprisingly, it was sitting there burbling away with a rich setting, just as you want with a new engine.

I spent the next few minutes bringing the head up to speed but without lifting off the ground, maintained that speed for a few more minutes, then dropped the throttle back down to idle for a minute. I repeated this process several times. The engine did quit on me once, suggesting that my caution was not unwarranted. Still, I was pretty impressed, as this was a brand-new engine. After getting about 10 minutes on the engine I could wait no longer, though if I was handing out recommendations, I would put at least a full tank through the engine, as described, before trying to leave the ground (this is especially true if you don't know what to do with the left stick if the engine dies). But I turned in the needle valve ½ turn and then brought the heli into a hover while leaving the gear balls touching terra firma (the gear drops considerably, so the heli can be at least a foot off the ground before you truly "break ground").

During the initial forays, I had to add some right rotor trim and considerable right cyclic. Before I even started the heli, I had added some forward cyclic trim, as I had done another experiment: I had used a standard, 600mAh pack to drive the receiver. These packs come with the types of radio systems a beginner would use, but heli guys typically fit larger batteries into helicopters, and they are designed accordingly. Thus, I knew I would have something of a tail-heavy condition, and the forward trim setting compensated somewhat. But what really surprised me was that when I eventually brought the heli into a hover, it was very solid. There were no vibrations to speak of, so some balancing must have been done during the factory assembly. The controls were all responsive, suggesting that some care had been taken to make sure the linkages were free to move. I was impressed.

SO WHAT'S THE BIG DEAL?

So what is it about the Shuttle Challenge that has me saying that it's *the* training tool for entry-level helicopter fliers? What is it about this heli that allowed the Altech folks to have a steady stream of non-heli fliers getting stick time on it at last year's Hirobo Cup?

The training gear is the most evident feature. The rods are long, and as I've said, you can hover a foot off the ground without actually leaving it. Initial baby steps in heli flying involve hovering the heli only an inch or two above the ground. You learn to hold the heli in one place in a hover then start moving it around a bit. But when you're this low to the ground, you also create a lot of turbulence because you're so low in ground effect. It's actually more difficult to fly this way, though the heli is less likely to require repair if you get confused. The longer rods of the Shuttle Challenge let you learn this stuff a bit higher in the air column and give a newbie some experience moving up and down as well as left and right without jeopardizing the machine. Also, each of the rods extends and moves independently, so if you hit the ground nose first, the front rods slide and cushion the blow, while righting the helicopter well in advance of the heli reaching the ground.

But while the gear is the clearest indicator that this is a trainer helicopter, training gear doesn't make a helicopter easier to fly, and it doesn't prevent boom strikes in the way that the Shuttle Challenge's engineering does. The head design is what does that, and it's crucial to providing the properties that make the Shuttle Challenge great.

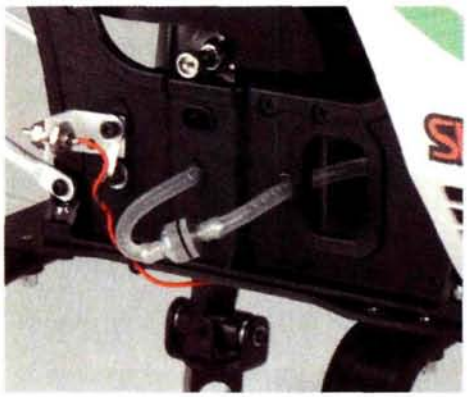
The specially designed blade holders help prevent the blades from flexing downward and hitting the tail boom. The infamous "boom strike" is *very* hard to do with the Shuttle Challenge. Lest you think I'm overstating the importance of this feature, the so-called "repair kits" sold by heli vendors provide a set of blades, a new tail boom and some peripheral hardware to replace what tends to get bent during a boom strike. It's certainly the most common crash problem newcomers face.

But other differences make the Shuttle Challenge easier to fly: it comes with heavier, solid flybar paddles and stabilizer weights. This slows the flybar's response to control. The see-saw design favors Hiller control (control of cyclic by adjusting the angle of the flybar paddles) over Bell control (control of cycle by adjusting the angle of the rotor blades directly). Most model helicopters use a mix of these two control methods. By favoring Hiller control and using heavier paddles, the Shuttle Challenge goes a long way toward solving the beginner problem of heli overcontrol.

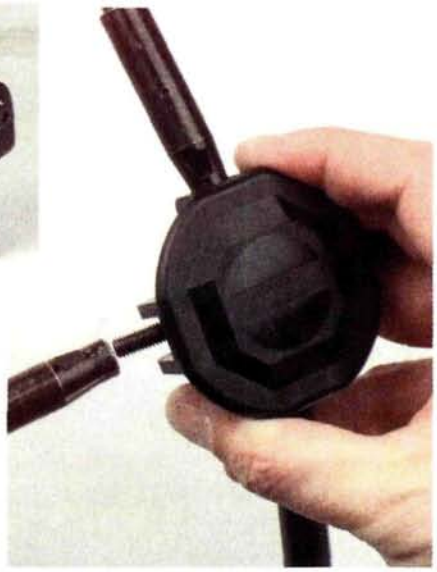
I should mention that the Challenge comes with a standard set of landing gear and that with two parts, the head can easily be upgraded to a conventional one. When you're ready for more advanced flying, you won't need to purchase a new helicopter. The Challenge also includes a starting wand, a blade holder and several tools to assist in setup and maintenance. It also comes with something unique: crash protection. The folks at Altech are so sure you can learn to fly with a Shuttle Challenge without crashing that for the first 60 days, they'll give you your first set of crash parts.

So to answer the question, "What's the big deal?": the Shuttle Challenge provides a training platform that is easier to fly and will also withstand considerable hard knocks. If you've been thinking of trying helicopters, now is the time; the tool has arrived.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ✦



The fuel filter is supplied; I added the remote glow igniter.



Inset: each training-gear rod slides through a fixture. Right: the gear legs can be screwed on for flight and off for transportation.

PRODUCT NEWS

Latest product releases

INFORM YOUR CUSTOMERS! **Model Airplane News is interested in showing our readers your new products—here in Product News. If you'd like to see your products here, send us clear photos and a press release that provides information about them! We'll publish as many as space permits.**

Send your announcements to: Product News, Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

HOBBY HANGAR

Pen Grip Orbital Sander

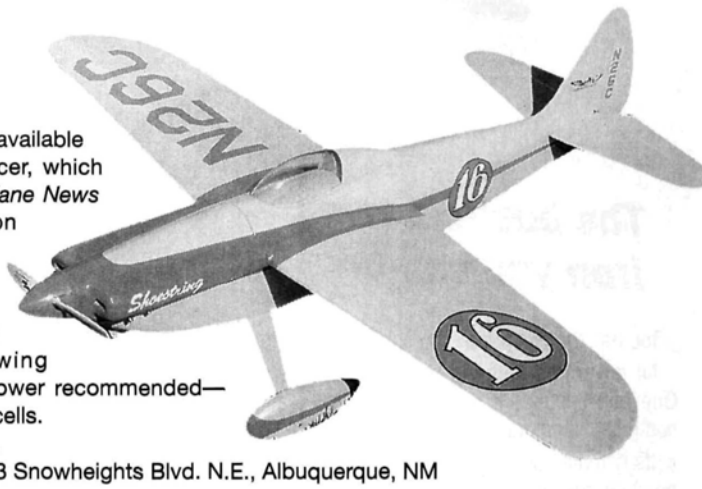
This new Minicraft 100W Orbital Sander has a unique pen grip that provides extra control for intricate, close-up jobs and for reaching into small places. It also features palm- and pistol-grip positions. The tool uses fine- and coarse-grit Velcro®-brand sanding pads. For a complete color catalog of the Minicraft line of tools, send $2 to Hobby Hangar.

Part no.—MB561; **price**—$54.95 (plus $6 S&H).

Hobby Hangar, P.O. Box 417, Hebron, KY 41048; (606) 334-4331; website: www.hobbyhangar.com.

PAT'S CUSTOM MODELS

Speed 400 Shoestring



A laser-cut short kit is now available for this scale schoolyard racer, which first appeared in *Model Airplane News* in the May '99 construction article. The kit includes plans, instruction and pattern sheets and 39 laser-cut parts. Specifications: wingspan—30.5 inches; wing area—165 square inches; power recommended—direct-drive Speed 400 on 7 cells.

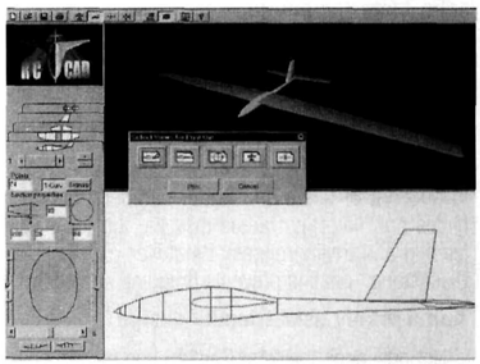
Price—$34.95 (plus $5 S&H).

Pat's Custom Models, 10313 Snowheights Blvd. N.E., Albuquerque, NM 87112-3054;

websites: www.thuntek.net/pcmodels or www.rd-tec.com/pcm.

AVENTURE NEW MEDIA SARL

RcCad



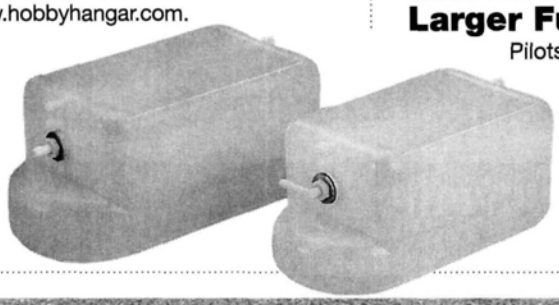
This Radio Control Computer Aided Design software is specially designed to help modelers create airplanes. It supplies a real-time 3D image of the model you are designing. It is easy to use, fast and inexpensive. When you change the features of your plane, the 3D view is immediately updated, and you can rotate, zoom in, etc., in real time.

Prices—$49.95 (online at www.rccad.com), $59.95 (CD version).

Aventure New Media SARL, Senaleche 23B, CH-1009 Pully, Switzerland; fax +41 21 728 97 34.

GREAT PLANES MODEL MFG.

Larger Fuel Tanks



Pilots of ¼- and ⅕-scale models will appreciate these new 24- and 32-ounce fuel tanks. Sturdy and flexible, these tanks are easy to assemble and don't use brass tubes.

Part nos.—GPMQ4112 (24-ounce tank), GPMQ4115 (32-ounce tank);

prices—$6.99, $7.99.

Great Planes Model Mfg. Co., 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-36300; fax (217) 398-0008; website: www.greatplanes.com.

BALSA USA

1913 Etrich Taube

One of the few WW I models that's easy to build and even easier to fly, the Balsa USA Taube features a thick, semi-symmetrical airfoil and light wing loading. The kit features rolled, full-size plans; photo-illustrated instructions; die- and jig-cut parts; bent landing gear; and a complete hardware package. Specifications: wingspan—83.5 inches; wing area—1,250 square inches; length—63.5 inches; weight—8 to 8.5 pounds; engine recommended—.60 to .80 2-stroke or .70 to .91 4-stroke.

Kit no.—394; **price**—$149.95.

Balsa USA, P.O. Box 164, Marinette, WI 54143; (906) 863-6421; fax (906) 863-5878.

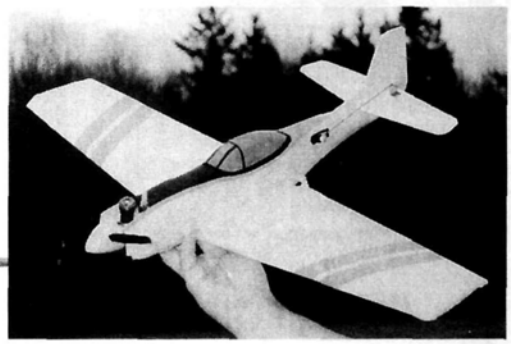
SIG MFG. CO.

Kadet LT-40 ARF

This trainer features an all-wood, prebuilt airframe covered in white Oracover. The provided decals allow builders to duplicate the box color scheme or create their own. It comes with American-made hardware and pushrods and Du-Bro wheels, spinner and fuel tank. Specifications: wingspan—70 inches; wing area—900 square inches; weight—5.5 to 6 pounds; radio required—4-channel; engine recommended—.40 to .46 2-stroke or .40 to .54 4-stroke.

Kit no.—RC-67ARF; **price**—$179.95.

Sig Mfg. Co. Inc., 401-7 S. Front St., Montezuma, IA 50171-0520; (515) 623-5154; orders (800) 247-5008; fax (515) 623-3922; email: mail@sigmfg.com; website: www.sigmfg.com.



JK AEROTECH

Pocket Planes P-51

This ½A combat plane can be built in less than four hours and is very durable and exciting to fly. The model can be set up for fast roll rates and loops or tamed down for fast, stable flying. The kit comes with CNC-cut pink foam fuselage and wings, die-cut Coroplast tail section and fuselage doublers, a hardware package and a roll of colored packing tape. Specifications: wingspan—26 inches; length—21 inches; radio required—2-channel with rudder/aileron, 3-channel with throttle; power recommended—JKA Slickmount .049 to .061.

Price—$29 (plus S&H).

JK Aerotech, 10800 S.E. Orient Dr., Boring, OR 97009; (800) 442-6755, (503) 663-4081; website: www.teleport.com/~jdickman/JKAerotech/JKA.shtml.

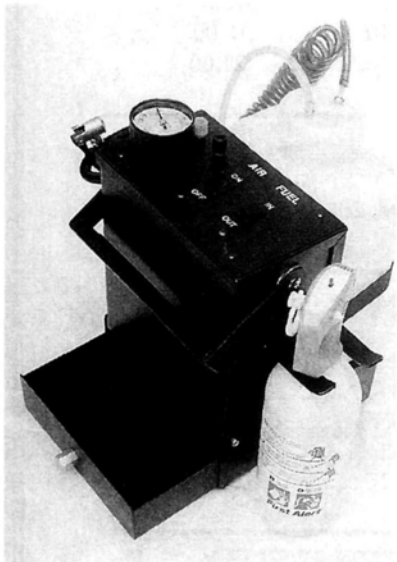
ACER RACING

Powerpole Connectors

Available for individual or bulk purchase, these new connectors have a redesigned barrel that will accept 12AWG wire but is still compatible with Litespeed and Sermos connectors. The connectors are silver-plated and are spring-loaded to ensure a tight, clean connection with every use.

Prices—$3 (two pairs), $12 (10 pairs), $48 (50 pairs), $90 (100 pairs).

Acer Racing, P.O. Box 5680, Santa Monica, CA 90409-5680; (310) 775-6435; fax (310) 472-4870; email: info@acerracing.com; website: www.acerracing.com.



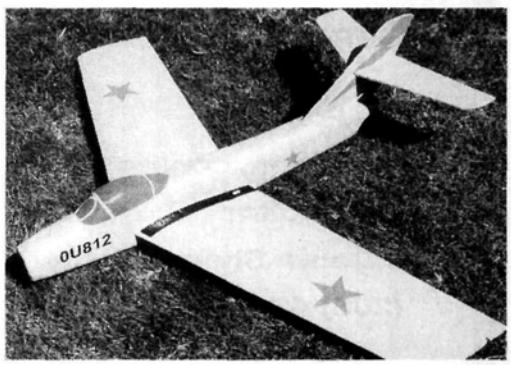
NICK ZIROLI PLANS

GSE 2000

The Ground Support Equipment 2000 is designed specifically for modelers who fly giant-scale models. The sturdy, vented aircraft-aluminum unit features a heavy-duty, 12V battery; a high-volume air compressor; a rapid-fill gas pump; a 0 to 250psi gauge; two, high-quality rocker switches; and external power connectors. A Velcro®-retained, 64-ounce Nalgene container with fuel/refuel lines stores the gasoline, and a dry-powder fire extinguisher is mounted outside the unit. The GSE 2000 has a drawer for smaller accessories and is finished in black-powder coating for durability.

Price—$149.95 (introductory special).

Nick Ziroli Plans, 29 Edgar Dr., Smithtown, NY 11787; (516) 467-4765; fax (516) 467-1752.



MM GLIDER TECH

MiG 15 Foamie

Made for combat and PSS, this swept-wing jet glider features an EPP fuselage and wing-cores, die-cut Coroplast tail surfaces, precut, 2-inch-wide ailerons, hardware, instructions and a logo sheet. It uses standard radio gear, and all parts fit together nicely. Specifications: wingspan—48 inches; wing area—480 square inches; length—36 inches; radio required— 2- to 4-channel; weight—20 to 25 ounces. For a free catalog, send an SASE.

Price—$57.95 (plus $5 S&H).

MM Glider Tech, P.O. Box 39098, Downey, CA 90239; (562) 927-2583; email: mmglidrt@keyway.net; website: www.mmglidertech.com.

WWW.SRBATTERIES.COM

Everytime we sit down to do a new ad, we don't know where to begin. If we do an ad about our battery packs, people call wondering if we're no longer making kits or publishing *R/C Techniques* and *Electric Flight Techniques*. If we do an ad about our kits, people think we're no longer making battery packs for modelers or that we've stopped pubishing *Techniques*. It often seems like there's no right way to keep you informed about what's new at SR Batteries. • Well, all of that has changed! Thanks to the world wide web, WWW, we can now not only keep you up to date, we can keep you up to the minute! If we release a new kit, you'll read about it two or three *months* sooner at srbatteries.com . If we release a new *Techniques* volume, you'll read about it two or three *months* sooner at srbatteries.com . And finally, if we release a new cell or technical information about one of our packs, you'll read all about it *first* at srbatteries.com! Naturally, our site lists pricing and technical information covering all of our products. You'll find the sizes and weights of all of our packs and individual cells as well as photos, specifications, and descriptions of our ARF and laser cut kits. In addition, there's a detailed index to all of the volumes in the *Techniques* library. • SR Batteries, Inc., Box 287, Bellport, NY 11713, Phone: 516-286-0079, Email: info@srbatteries.com

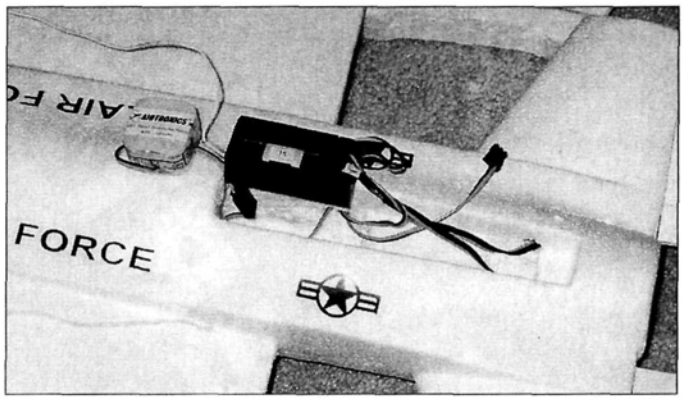
MODEL AIRPLANE NEWS
HOW TO

Add power and R/C to Robart's foamie F-16

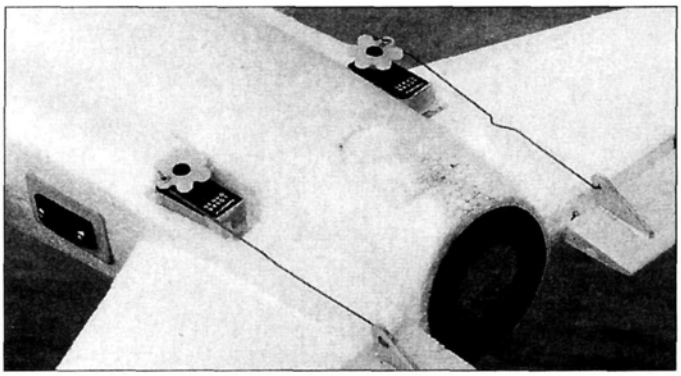
by Nick Ziroli Sr.

Simple, inexpensive and fun

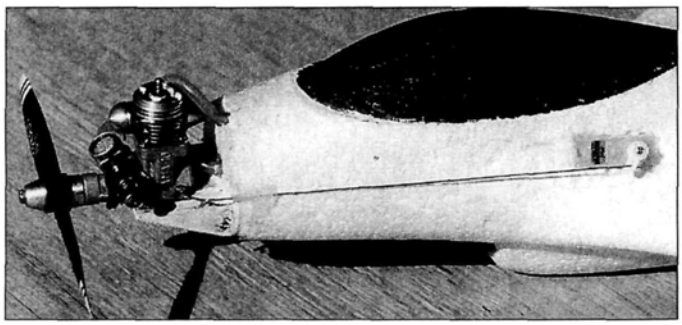
The first time I saw the Robart Mfg.* F-16 throw glider, I thought about converting it into a powered R/C model. Robart produces a series of Top Gun molded Styrofoam throw gliders that are available in department, toy and hobby stores. Besides the F-16, an F-117 Stealth Fighter and a UFO Space Plane are available. These planes all have wingspans of about 18 inches, and the F-16 is more than 25 inches long. No assembly is required, other than inserting the vertical fin in a slot in the top of the fuselage. Each plane comes with a set of colorful stick-on graphics to dress it up. These are rugged models that will take a lot of abuse, but if they do break, the parts can be glued back together with 5-minute epoxy or white glue. With a retail price of $9.95 or less, these Top Gun gliders are a good value, and converting them to power and R/C requires only a few hours' work. I used a Cox* Golden Bee reed-valve engine on my first F-16 test model. When the needle valve is right, performance is quite lively. For some real excitement, use a Cox Tee Dee .049 to .051 or Norvel* .049 to .061. I built a second F-16 and powered it with the Norvel R/C .061. This is a great little engine at a reasonable price, and I recommend it for the F-16.



A small Airtronics 4-channel receiver and 100mAh battery are used in the 2-channel F-16; a 275mAh battery is used in the 3-channel version.



Small commercial horns and pushrods may be used, or plywood horns and simple wire pushrods, as shown here. Note the switch mounted on the side of the fuselage.



A Norvel .061 R/C engine is a perfect match for the F-16. A Maxx MX-50 sub-microservo controls the throttle.

AT THE WORKBENCH

I found that the best approach is to mount the motor, then position the radio system to obtain the correct balance. If done properly, no additional ballast will be needed. Remove the steel disk that's in the nose ballast hole, and cut the nose off the fuselage with a razor saw or hacksaw blade. If you plan to use the Golden Bee, make the cut 2 inches forward of the canopy edge; make it 1½ inches for the Norvel. Make the cut a little long, and sand in 2 degrees of downthrust and 1 to 2 degrees of right thrust. Trace the firewall shape of the nose onto a piece of ⅛-inch-thick aircraft plywood. Cut this out and epoxy it to the nose. A ½- to 1-ounce fuel tank will have to be buried behind the firewall of the Norvel-powered F-16. I used a ½-ounce plastic bottle, but Norvel's ½-ounce fuel-tank engine mount would be perfect for this installation.

The F-16 is controlled by elevons on the stabilizer. This takes two channels and a transmitter that will control a delta or flying-wing model; V-tail mixing will not work. If it is not possible to get the elevon mixing, ¾-inch-wide strip ailerons can be hinged to the trailing edge of the wing. A servo mounted in the fuselage can control them via a Du-Bro* ½A aileron linkage (part no. DU-231) or one similar. The best control would probably be a full stabilizer-span elevator of 1x¼-inch balsa tapered to the trailing edge and operated by a servo in the aft end of the fuselage; however, the elevon system is simple, different and works well.

For elevon control, mount the servos with the output shaft about 2½ inches forward of the elevon hinge line. I used two Airtronics* 94501 Microlite servos, which weigh about ½ ounce each. Sub-microservos are not really required, although I did use a Maxx* sub-micro MX-50 for throttle. Cut a hole for each servo that will be a snug fit. To mount the servos, I simply wrapped their bottom halves and mounting tabs with masking tape then epoxied them into place. A small amount on the sides will hold them securely. When you remove the servos, peel off the tape and they'll be as clean as new.

The elevons should be 1⅛x¼-inch balsa tapered to the trailing edge. Hinge each one with two, ½-inch-wide sheet-plastic

hinges or Robart ½A Hinge Points. CA will melt the foam, so use water-based glue such as Pacer* Hinge Glue to hold the hinges in place. I made a few 1/16-inch plywood control horns for the elevons, but the small nylon ½A ones sold by Goldberg* or Du-Bro would work well, too. For pushrods, I used 1/32-inch-diameter wire bent to length and with a Z-bend on each end. Standard pushrods with a Z-bend on the servo end and a small nylon link on the other would allow you to adjust the length.

The slot for the fin was just wide enough for my receiver and battery to fit. I used an Airtronics 92745/72 4-channel receiver and a 100mAh battery pack in the Golden Bee-powered F-16 and a 275mAh battery in the Norvel version. The receiver is about 7/8 inch square. I gouged out the foam to make room for the receiver and battery below and forward of the fin slot, then positioned the receiver and battery to obtain the correct balance point. This should be 13 inches forward of the end of the tailpipe. You will more than likely have to hollow out the fuselage in front of the fin to move the equipment forward for proper balance. Make the opening just large enough for the receiver and battery to fit. You won't need foam rubber padding, as the foam model itself is soft enough to protect the radio. Place the battery in front of the receiver. The lighter the radio system, the farther aft it will have to be positioned. I mounted the battery switch to a piece of 1/32-inch-thick plywood and glued it to the flat side of the fuselage between the wing and stabilizer.

Completed models weigh 11¼ ounces for the Cox-powered model and 12¼ for the Norvel version. Microservos and receiver such as those offered by FMA Direct* could reduce that by an ounce or two.

The antenna on the first model was run out the front of the fin opening, around the leading edge of the wing and bottom of the fuselage, and up and over the opposite wing through a hole in the trailing edge. On the second model, the antenna runs out the fin slot, up through a hole in the top of the fin and trails aft from there. Be sure to tape or pin the fin in place; we lost it on one flight! The glider flew well as long as the fin was still attached to the antenna because the drag was enough to maintain stability. When the fin came off the antenna, the F-16 went into a such a flat spin that it landed with no damage.

Set the elevon throw so the elevator control moves it 3/16 inch up and 3/16 inch down. Aileron control moves them ¼ inch each side of neutral. If the ailerons are on the wings, they should travel 3/16 inch each way. The elevons or elevators seem to like a touch of up-trim for neutral (1/16 inch at the most). Trimming them at neutral requires moving the balance point aft, and this makes the glider much too sensitive in pitch, even with reduced throw.

The F-16 on a flyby. The model is fast and will perform big loops, rolls and other maneuvers that don't require a rudder. This is not a beginner's model.

FLIGHT TESTS

The first flights on both F-16 models were successful. The only changes I made to the first Cox-powered model were to retrim the elevons and move the balance forward. The Norvel-powered model was set up as described and flew with only minor transmitter trim adjustments. I'm sure I don't have the optimum setup, but it seems to work well for my daredevil flying!

Launching is easy, since all the gliders in the Top Gun series are made to be hand-launched and have finger holes molded into the underside of the fuselage. Hand-launch them at a good rate of speed and with the wings level.

The Norvel F-16 is very maneuverable. It will perform big loops, rolls, split-S's and many other maneuvers that don't require rudder control. It's also very fast and exciting to fly. My only caution—and this is true of many models—is that the glider won't turn well if the nose is high or in a stalled attitude.

Carelessness on one flight caused a crash that broke one F-16 into four pieces. It could have been repaired at the field and, at home, it took only 15 minutes and some 5-minute epoxy to make it airworthy again. I've had a lot of fun flying these little F-16 hot-rods. How about a club pylon race with these models? It would be interesting to see how the Robart F-117 and UFO gliders adapt to R/C. If you're the type of modeler who likes something a little different, give one of the inexpensive F-16s or other Robart Top Gun gliders a try.

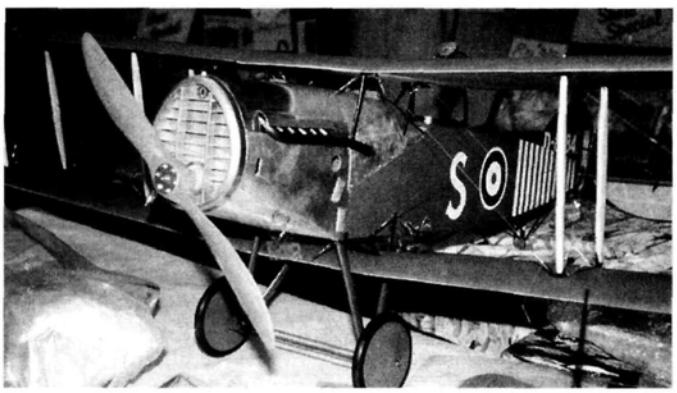
**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

The basement guy

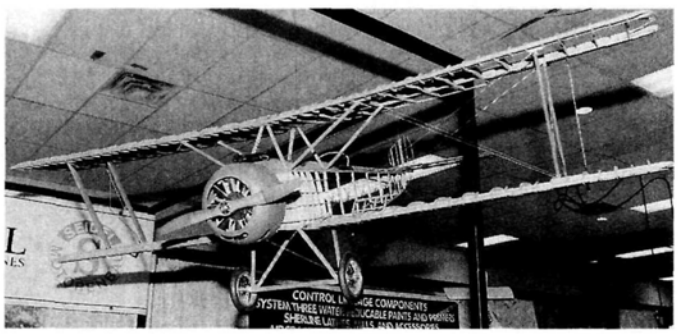
I WANT TO START by thanking Larry Marshall for his March 1999 editorial entitled "The Social Side." Like many other hobbyists, I felt he captured in words the feeling I have for the hobby yet have a hard time expressing. Nice going, Larry.

The photo of my workshop, however, has spurred an interest the likes of which I have never before seen. I called Jerry's R/C Hobbies in Green Brook, NJ, to order some paint, and when I gave the gentleman my name, he said, "I know you from the picture in *Model Airplane News*." I figured he meant the one alongside my column heading, but he proceeded to tell me how much he liked my basement and hopes to have one like it someday, and, "Oh, yeah," my column was OK, too. My dad called me at work later that day and asked when I had the time to clean my basement; it had not looked that neat when he visited. I had not even seen the March issue, but I sensed something was going on. Sealed in my copy of the quarterly journal of the "Southern Scale Warbirds" was a handwritten note from editor Chris Joiner. He commented on my "huge" basement and how much he liked it.

I guess the message was clear: I can write what I think are the best "scale" columns in the U.S.; I can do well at Top Gun and the Scale Masters; but my legacy will probably be as "George, the basement guy." Is this a terrific hobby, or what?



Three Sea Bees showed this great-looking Bristol F2B fighter. Yes, it is an ARF and comes out of the box needing only basic assembly and engine and radio installation.



Proctor is now selling its Sopwith 1½ Strutter. Part of its VK line of kits, the Strutter has many accessories to make it a serious scale competition machine.

NORTHWEST HOBBY EXPOSITION

I just got back from the Northwest Hobby Expo in Puyallup, WA, and I came away really jazzed up.

Proctor Enterprises* is under the new ownership of Joe Topper and Gary Parker, and the company's future looks pretty good. At this year's Puyallup Expo, Proctor showed the impressive Sopwith 1½ Strutter. It is part of Proctor's VK line, and with a 67-inch wingspan, the model is IMAA-legal. Included in the kit are all the balsa, plywood, hardwood and spruce required for construction and a hardware package that contains all the items needed to complete the aircraft. The plans consist of three sheets of full-size drawings and a thorough, 19-page construction manual. The plans are beautifully drawn and inspire you to start building the kit right away

The Strutter is designed around the Laser .70 4-stroke engine, and Proctor carries the entire Laser engine line. If you truly want to truly "scale out" the model, Proctor offers an optional Lewis gun and a scarf-mount ring for the rear gunner along with fittings for dual cables, lightweight full-body pilot figures, spoked wheels, etc. As I always tell people: if you look up WW I scale in the dictionary, the name "Proctor" is in its definition.

Also in the Proctor booth was premier scale modeler Dick Hansen. Dick usually competes with a Proctor DVa or a Nieuport 11, but he is also known for his company, Hansen Scale Aviation Videos*. I just got Dick's video of the 1998 U.S. Scale Masters Championship in Columbus, OH. The 2-hour tape also includes a tour of the Grissom AFB Museum in Peru, IN, some terrific flight sequences and the unfortunate demise of a well-known, all-silver B-29 Super Fortress.

An interesting side to Dick's tapes is his close relationships with the pilots. Being a fellow competitor, Dick gets them to open up and talk about their planes, and he does not hide his emotions when he sees a beautiful aircraft. If you buy four videos from Dick, he gives you a fifth for free. I really like Dick's tapes and recommend that you check them out.

Three Sea Bees Models* showed its ever increasing line of custom WW I ARF kits. This year, a Bristol F2B fighter was on display. The ⅕-scale Brisfit matches the other planes in the series, but with a 94-inch wingspan, the F2B is huge. Flying weight is only 16 pounds, and a .90 to 1.08 2-stroke or a 1.20 4-stroke engine will power the model nicely. The company offers it completely painted and in a simple olive-drab base color without markings for those who wish to apply their own paint. ARC versions will also be available. Accessories for the Brisfit include a functioning exhaust manifold and a detailed cockpit interior. The wheels, machine gun and ring mount, clevises and flying wires all come with the kit.

Air Magic displayed this very impressive F-15 Eagle. The high-end kit comes with a fully detailed fuselage and several functional scale features.

NEW JET STUFF

Air Magic* had two beautifully crafted jets on display at its booth, a T-38 Talon and an F-15 Eagle. Both are designed for turbine or ducted-fan propulsion, and both

SUPER FIL FILLETS

This technique came about after a conversation I had with Chip Mull at the Hobby Expo. We were talking about Super Fil, a lightweight, two-part, epoxy-based sandable filler he sells. I wanted to add wing fillets to my Midwest AT-6, but I already had the fuselage and wing primed. Chip suggested that I could apply Super Fil directly over the primed surfaces without a problem; being water-based, it can easily be shaped while it dries, and this minimizes sanding. Here's how I did it:

Available from F&M Enterprises, Super Fil is a lightweight, 2-part, epoxy-based filler ideal for forming wing fillets.

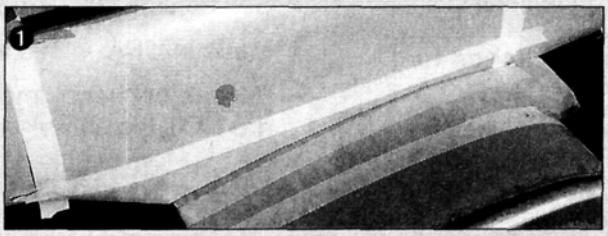
Before I bolted the wing to the plane, I taped wax paper over the center top of the wing where the fillets would be. Next, I masked off the edges of the fillets on the fuselage and the wing with masking tape to give me sharp, straight edges. The two parts of Super Fil are blue and tan, and when mixed correctly, the mixture turns light blue and has a consistency similar to Model Magic filler. I applied the filler to the wing fillet area and used a spoon to form it into the shape of the fillet. I let it stand for about 20 minutes, and then finished it by shaping and smoothing it with some water and my index finger.

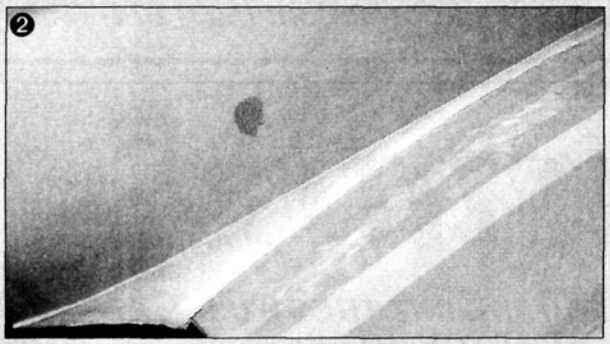
The next day, I sanded the fillet with 220-grit paper wrapped around a 1½-inch diameter dowel until I was satisfied with its contour. I filled low spots with automotive-lacquer spot putty, and I sanded the fillet again until it was smooth and uniform. Super Fil works very well for forming wing fillets, and it added much to the looks of my T-6.

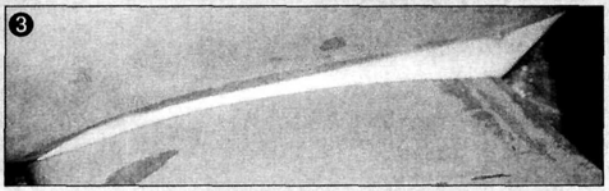
Some suggestions for using Super Fil:

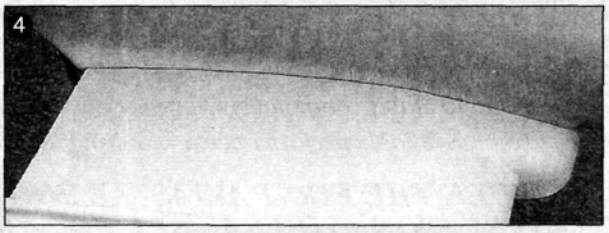
- Let it stand for about 15 minutes after mixing; it has the correct texture for easy application after it has stood for several minutes.
- Set-up time for the product is about 8 hours, so don't rush as you would while working with Bondo.
- Do not use too much water when you smooth the surface of the filler; you could wash away some of the material. If you do this, let the area dry for a few minutes, and then add more Super Fil and try again.

That's it for now; see you at the flying field and remember, fly scale.





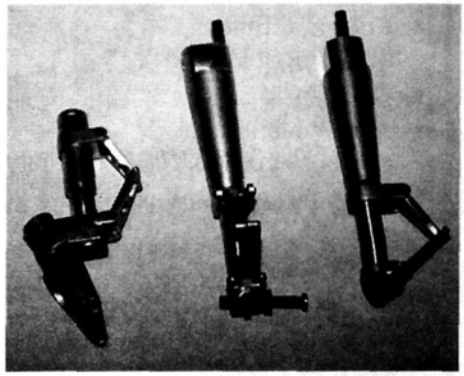




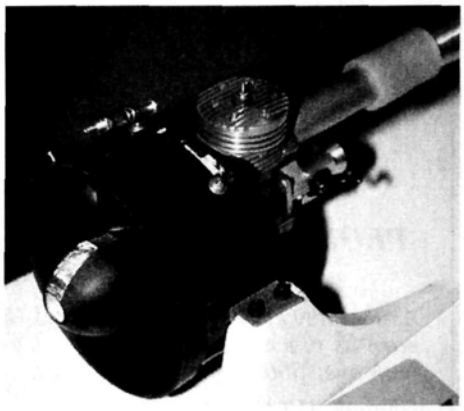
1. Cover the wing center section with wax paper, and attach it to the fuselage. Clean the surfaces well, then use tape to mask off the shape of your fillet. 2. Apply the filler to the area between the edges of the masking tape and roughly shape it with a spoon. Shape and smooth the fillet further using water and your index finger, and when you have the shape you want, carefully remove the masking tape. 3. Let the filler dry overnight, and then remove the wing. Sand the fillet smooth, and fill any low spots with automotive-lacquer spot putty. Here, the wax paper has been removed and the wing reinstalled. 4. This is what the primed fillets look like. Super Fil is easy to work with and produces strong, light fillets.

are very well engineered. The F-15 really caught my eye because of its beautiful paint scheme and exceptional detailing by Air Magic owner, Jim Dyck. The F-15 also features a canopy that opens and closes, a drag brake and articulated air inlets—very scale indeed.

Air Magic kits are very complete and employ modern, lightweight molding techniques that make the jets ready for finishing straight out of the box. Panel lines and hatches are molded into each aircraft.



Above: Larry Wolfe of Jet Hangar Hobbies showed some new custom landing-gear struts designed for several of his kits. Here is the strut set for his Grumman Cougar and Panther kits. Below: also shown in the Jet Hangar Hobbies booth was the new K&B .48 ducted-fan engine. Here, the rear-exhaust powerplant is mated to a Turbax fan unit.



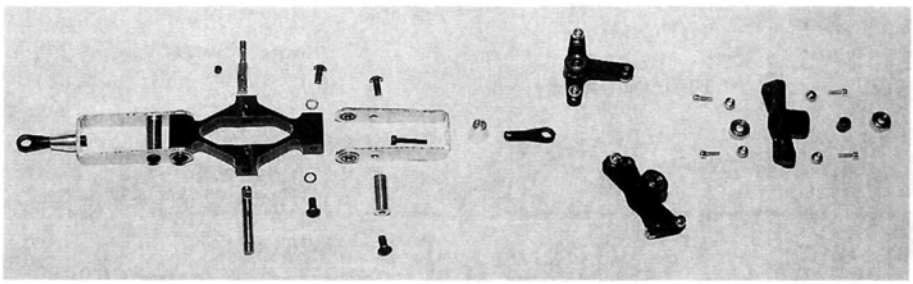
The completed F-15 cost over $2,500, but it is a good price for what you get. If you compare it with some of the other high-tech, prefabricated designs available today, you'll see that it is right in line with quality and pricing.

Jet Hangar Hobbies (JHH)* displayed some new, custom-machined landing-gear struts for its Mirage, Cougar, Phantom and Panther kits. They are machined from aluminum and have a good deal of detail, including correct strut-to-axle angles and functional Oleo shock absorbing, where necessary.

Also on display at the JHH's booth was the new K&B* .48 ducted-fan engine. This powerplant will be available from JHH

Continued on page 128

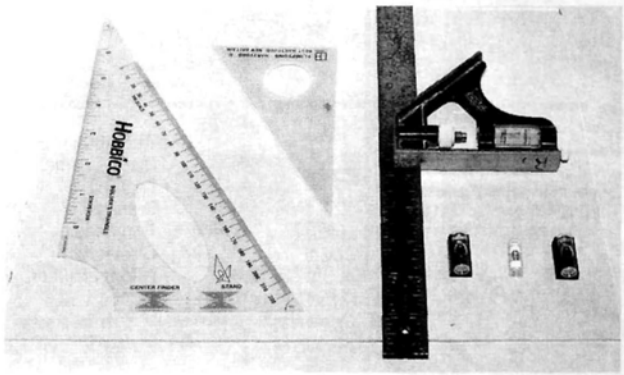
Building straight frames



Here are the parts that make up the RG's control subassemblies. To make it easy to find various subassembly parts, in most modern heli kits they are packaged together in numbered bags.

OVER THE PAST few weeks, I've started to receive email regarding this column. I really appreciate it, and I'd like to say thanks to all who took the time to write. One thing I would like to make clear, however, is that "Regarding Rotors" is geared toward beginners and those who have an interest in helicopters but don't know how to get started. This is why we started the Hirobo* Shuttle RG build-along project. Its construction is typical of many of today's helicopters, and I want to give you some tips that aren't found in construction manuals. As our build-along project progresses, I'll be talking about setting up heli controls, and I'll explain some techniques I use to help people learn to hover. Other topics that I plan to cover are forward flight, aerobatics, autorotations, etc.

This month, we'll look at subassemblies, discuss upper and lower frame assembly and how to make sure that we build the chassis straight.



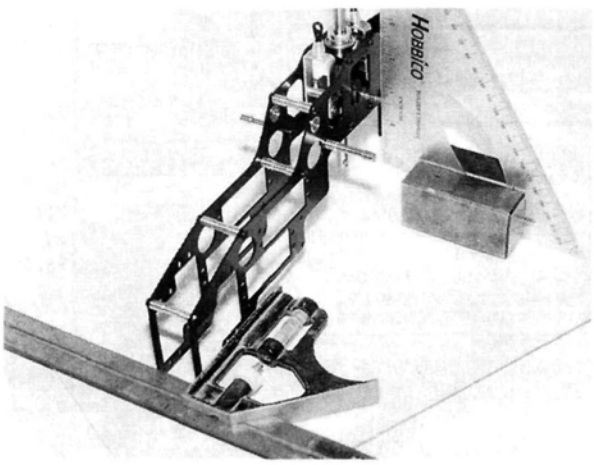
Right: the supplies needed to build straight and true frames are a combination square, a couple of right triangles, a sheet of glass and some bubble levels. Straight and true frames lessen vibration and built-in alignment stress.

Below: to check the straightness of the frame parts, place them on a flat sheet of glass. If the frame is bowed, twist and tweak it slightly until it lies flat.

WHICH PARTS DO I NEED?

When building helis, it's good to be organized. And to help us, most heli manuals have full-size drawings that show the type and quantity of fasteners needed for each construction step. Many kits include parts and fasteners packaged together in numbered bags that correspond with the assembly steps shown in the manual. For example, bag no. 1 contains all the parts and fasteners needed to build the subassemblies shown in step no. 1; bag no. 2 is for step no. 2, and so on. This speeds construction by making it very easy to find the parts you need.

Once we've assembled the parts, we do not want anything to come loose during flight, so the golden rule here is to use thread-lock (Loctite* 242 blue) on all metal-to-metal fasteners. But first, I de-grease all the bolts and setscrews so the thread-lock will hold properly. I saturate a small area of a rag with alcohol; then I use an Allen driver to turn the fastener in the rag while I pinch it between my fingers. You'll be surprised how much oil comes off the bolt. To apply thread-lock, I use a toothpick to put a small drop or two into the fastener's hole; not much is needed for a secure bond. Be careful not to get thread-lock in any bearings because this will cause them to bind up. Do not use thread-lock on fasteners that thread into plastic because over time, it will dissolve and weaken the plastic.



Here, the upper frame parts are assembled and the triangle and square confirm that the parts are properly aligned. Note that the frame is on a flat sheet of glass.

DRY RUNS

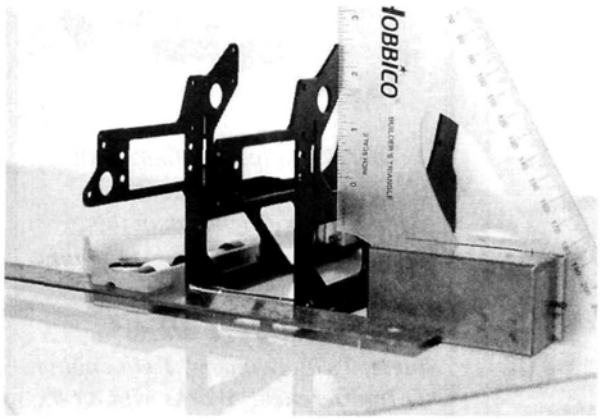
The first subassembly to build for the RG is the elevator lever; it's very easy and straightforward. As we assemble the two upper frames, the elevator lever will be captured between them and between the main shaft bearing blocks.

I like to lay out all the parts I'll need to complete an assembly before I build it so I can visualize how the assembly will go together. I then do a "dry run" and assemble the parts without using thread-lock or fully tightening the fasteners, just to make sure the assembly is correct.

Screw the ball links to the A-arms before you attach the arms to the lever body. When you attach the pivot shafts to the lever body, notice that "flats" have been ground into the shafts. These flats are where the setscrews "bite" and prevent the shafts from rotating.

Place a drop of thread-lock in the holes for the setscrews, and tighten them onto the flats to secure the shaft.

The A-arms pivot on factory-installed ball bearings. To prevent these bearings from binding when the bolts are tightened, you must make sure that the shim washers are placed between the bearing and the lever body. When the assembly is completed, the A-arms should rotate freely without binding or slop.



The lower frames are assembled using the same procedure as for the top frame. The frame sides should be 90 degrees to the work surface.

When attaching the ball-link balls to the X-type bellcranks with the small, self-tapping screws, be sure to put the balls on the correct sides of the bellcranks. One thing that I do to make it easier to screw small bolts into composite parts is to tap just the start of the hole; this gives the screw a straight start. For 2mm screws, I use a 2-56 tap; while the thread size is not metric, it's very close and does the job very well. For peace of mind and to ensure that the bolts that secure the balls do not back out, place a small drop of slow CA in the hole before you insert the screw. The screw won't come out on its own, but you'll be able to remove it later. OK; screw on the balls and insert the spacers and bearings in the pivot holes, and the bellcranks are complete. Now, on to the upper frames.

FRAMES OVER GLASS

The Shuttle RG chassis features stacked, upper and lower aluminum frames that are supported by metal bearing blocks, threaded aluminum spacers and the radio tray. This type of chassis has proven to be very rigid and simple to build. One of the most important things for stacked-frame construction is proper alignment. By assembling the frames straight and true, you avoid building in alignment stresses that can cause premature bearing failure. Twisted frames can also cause cracks to form and vibration to occur.

Lay the frames on a hard, flat surface (I use a piece of glass), and check to see if they are bowed. Because metal frames are stamped out, most of them will have a very slight bow. Gently twist and tweak the frames until they lie flat. Also check for burrs (rough edges) and sand them smooth.

Before you screw the two upper frames together, press the pivot bearing into each frame. These bearings fit tightly into the frames. To ease their installation, I put them in the freezer for about an hour. As the bearings get cold, they contract, and this allows them to drop into place. When they warm up, they expand in the frame and fit very tightly without being forced. Forcing things only adds to the stresses that we're trying to avoid.

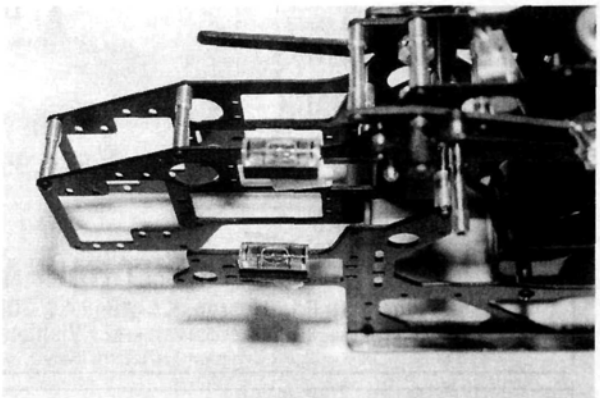
Follow the assembly diagram given in the manual, and loosely screw all of the upper frame parts together, making sure you capture the elevator lever between the frames. Also make sure that the pivot shafts on the elevator lever are on the proper sides of the frame. Now place the frames on a hard, flat surface and slide the main shaft through the bearing blocks. To ensure that the bearing blocks remain aligned, keep the shaft in place until the upper frames are completely assembled. Use a carpenter's square and a 90-degree triangle to align the frames so that they are even with each other fore and aft and are at 90 degrees (vertical) to your work surface. Now tighten all the bolts and check that everything is still square and true. Once everything is square and tight, remove one bolt at a time and apply some thread-lock.

The next step is to attach the collective-pitch lever to the chassis and to the elevator-lever assembly. The X-type bellcranks are now screwed into place on the chassis as indicated in the manual. Now is a good time to assemble the fuel tank. Just like in an airplane, the fuel pick-up clunk should move around freely and not hit the back of the tank.

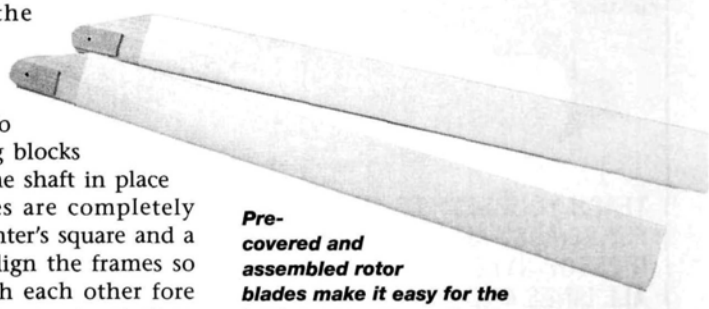
Since the engine/clutch/cooling-fan assembly has already been put together, we can skip this part and build the lower frames, bringing the upper and lower frames together to complete the chassis.

The lower frames are held together by the engine and engine-mount assembly and by two cross-members. Alignment is difficult here because the engine sits a little lower than the bottom of the frames, and this prevents you from placing the frames flat on the work surface. To get around this, I just install the engine mount and the cross-members. Once the lower frames have been aligned, you can loosely reattach the engine to the engine mount and properly align it later.

Once the engine is in place, attach the cooling shroud to the lower frame assembly and position it over the engine. Now lightly grease the engine-start shaft, place it in the clutch assembly, slide the shim washer onto the shaft and add the clutch bell. We are now ready to add the upper frame to the lower frame.



Here you can see the small bubble levels I removed from a broken carpenter's level; I use them to make sure that the upper and lower frames are properly aligned.



Pre-covered and assembled rotor blades make it easy for the beginner to reduce vibration; these are available from JR.

Gather all of the parts needed, including the various bolts and spacers, then loosely attach the upper frame to the lower one. I start at the rear and work forward, adding the spacers and attachment bolts. Be sure to use the proper length bolts where indicated. Also, make sure that the engine-start shaft is properly engaged in its bearing-support block.

To make sure that the upper and lower frames are in proper alignment, I use two small bubble levels. Mine are from an old,

broken carpenter's level. Place the chassis assembly on a flat surface and look for two straight edges (one on the upper frame, one on the lower), that are parallel to the work surface. Place a bubble level on each edge (tape them into place if necessary), and adjust the lower frame so it is level to the work surface. Now tighten the bolts that secure the frames to each other and check the bubble levels to make sure that the frames have remained level. Once you are satisfied that everything is correct, thread-lock and tighten all the bolts one at a time. You now have a perfectly aligned chassis.

This all may sound like a lot of work, but it really is quick and easy to do, and the method can be applied to any stacked-frame chassis assembly.

AFFORDABLE, FACTORY-COVERED ROTOR BLADES

One of the most difficult things for a beginner to do is to build a set of matching, wooden main-rotor blades. It really is an art that takes time to learn. Some kits come with prefinished blades, but most come with blades to which the modeler must add tip weights and then balance and cover. Then the weight and CG of the blades have to be matched. The helicopter will shake if the blades are out of balance, and this is one of the most common vibration problems with novices' first helis.

JR* recognizes this problem and now supplies finished, prebalanced main rotor blades in its Ergo Sport 60 kit. This makes one of the best heli buys even better. These blades are made of wood, and both the tip and root ends have been fuel-proofed at the factory. They come covered with a sticky-back material that, in my experience, has proven more durable than heat-shrink covering.

I recently got a set of these blades and have been flying them on my Ergo Sport 60. They are great 60-size sport blades and perform aerobatics well (even mild 3D). The first thing I did was to check their weight and CG locations; both were very close. One blade was 1 gram heavier than the other, and its spanwise CG location was 1mm farther out on one blade than on the other. These conditions were easily fixed by placing a piece of tracking tape on the lighter blade. By the time you read this, these blades should be available both separately (for about $40) and in kits.

Well, that's all for this month; keep the letters and email coming. I can be reached through the magazine or at rbell02@snet.net. Remember, fly safely and with purpose.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ✚

A matter of timing

I'VE RECEIVED QUITE a bit of mail asking the proper way to time a motor—or even whether it is necessary—so to build on Tim McDonough's May '99 "Current Thoughts" column that discussed how electric motors work, let's talk about timing.

Some people wrote that their motors lose power after a relatively short time in the air (meaning over the course of several flights); they're just not getting as many flights as they've come to expect. This usually involves the lower-cost ferrite motors, but it also happens with cobalt and neodymium motors. Why? As this column's heading suggests, it's a matter of timing.

Most motors are shipped in a state of neutral timing, and that isn't optimum for most airplane applications. It is a "safe" place for the manufacturers, since it allows their products to operate for as long as possible under a wide range of applications. We might be in great shape if we always drew 10 or 15 amps from our motors, but most of us use them in the 25A range, and that basically means that the motor timing is retarded for our use. Many of the more expensive cobalt and neodymium motors arrive with the timing advanced a certain degree to allow for their planned application, but you'll need to adjust them if you push them or add a gearbox. Most "can motors" arrive with neutral timing and can be used that way with good results if you don't push them beyond their designed load (they aren't designed to be adjusted, anyway; more on this later).

Before I jump ahead, let's look at some indications of incorrect timing:

- Brushes wear out very quickly.
- Large amount of brush trailing-edge fire while running.
- Excessive heat.
- Sudden loss of power after only a few runs.
- Low rpm for a given voltage.

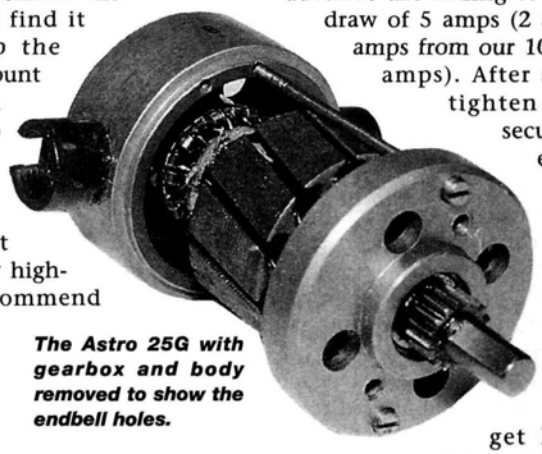
All of these can indicate improper timing, and you'll usually have a combination of them, as they feed off one another. Excessive heat and trailing-edge fire are the easiest for a novice to recognize. A common mistake made by fliers new to electrics is to bench-run their new equipment a lot. Bench-running a motor is tougher on it than flying it because the motor heats up very quickly when it doesn't have air flowing over it. If you've been doing a lot of bench runs, don't confuse overheating with a timing problem.

TIMING AND TESTING

To properly time your motor, you'll need to measure voltage and current (amps). I've found the easiest way to do this is with the AstroFlight* Whatt Meter because you connect it in line with your circuit, and it shows both voltage and amps. You can also use a multimeter that has a suitable current range. Most will handle 10 amps, which is fine for most timing applications, but to be certain the 10A limit isn't a problem, use an Aveox* or Modelair-Tech* shunt.

We'll be using the "10 percent" or "divide by 10" method, which is easy and accurate enough for most applications. In Bob Boucher's (AstroFlight) "Electric Motor Handbook," you will find a scientific method that requires much greater knowledge of electronic principles than we're going to cover here.

Before we can do anything about changing the timing, we need to set up our system and determine the no-load timing. I find it easiest to set up the motor in a test mount on the bench. A simple hose clamp mounted to a 2x4 in a vise works well for most motors except those that are very high-power. I *don't* recommend holding the motor in your hand, even though it doesn't have a prop. I set up the motor then attach my Whatt Meter, speed controller and battery pack (but no prop; remember, this is no-load current). This allows me to use the radio to run the throttle up to around 80 percent to get an initial reading of the current draw.



The Astro 25G with gearbox and body removed to show the endbell holes.

If you're timing an adjustable motor, you'll usually find two screws in the front endbell that will allow you to turn the brush holder or center body of the motor. Don't remove them completely; just loosen them enough to rotate the body or brush holder. Here's the tricky part: which way do you turn the body or endbell to advance the timing? The easiest way to remember is to *always rotate the body of the motor in the direction in which the shaft spins*. You could also remember to turn the brush endbell in the direction opposite to that in which the shaft spins. Either way will work, but because I want to advance the timing, it seems easier to remember to advance the body in the direction of the shaft's spinning.

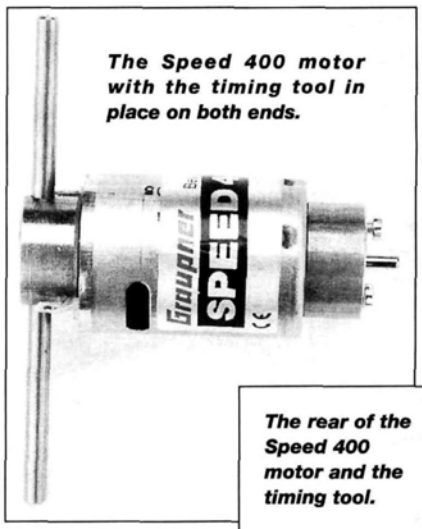
If you don't know whether the motor has already been set to neutral timing, do an initial run to see whether the current is at its lowest level. For example; we know that the no-load current of an Astro 25 at neutral is 2 amps. We can quickly check this by running the motor with about 80 percent throttle and then checking the meter. If it doesn't read "2 amps," rotate the body of the motor while watching the meter and stop at the lowest current draw (it should be around 2 amps). This is the position where the motor has neutral timing. If we intend to run the motor at 30 amps, we take 10 percent of that (3 amps) and add that to the neutral current to determine what the timing should be. In this case, we want to advance the timing to reflect a current draw of 5 amps (2 amps neutral + 3 amps from our 10 percent rule = 5 amps). After setting that, we tighten the screws to secure the body and endbells, and we've finished. Simple, huh?

Of course, you knew there was more to it, didn't you? It's important to remember that these motors can get hot in a hurry when you're testing them with no load, so allow the motor to cool between adjustments. When you adjust for neutral timing, remember that as you advance the timing, the rpm and current will always increase, but if you retard the timing past the neutral point, the current will go up but the rpm won't. You can very easily hear the rpm change, so this is also a good way to tell whether you're rotating the body or endbell correctly. With a bit of practice, it will take only a few seconds for each check and adjustment.

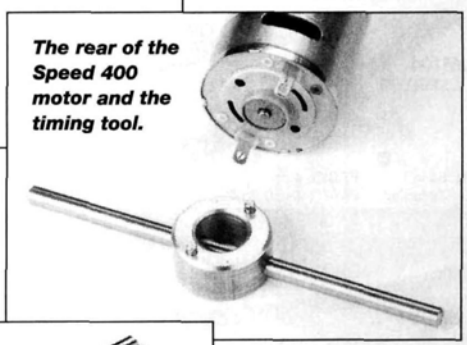
MORE HELPFUL HINTS

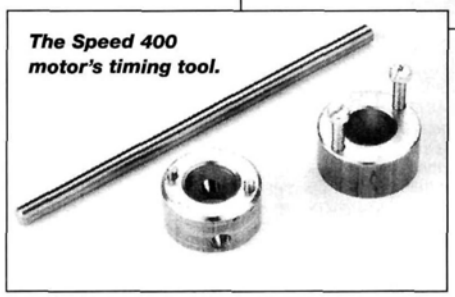
A question I'm commonly asked about timing Astro motors is this: "I reversed the endbell to reverse the motor direction for a pusher application (or to add a gearbox),

but I can't get the timing to advance as far as I need it to; what's wrong?" The problem can usually be traced to the user's neglecting to change the holes in the rear endbell when he or she has reversed direction. Astro uses two sets of holes in the rear endbell. With the body removed, you can see the tightening screws in the right-hand set of holes because it is a geared motor; in direct-drive motors, the screws are in the left-hand set of holes. What usually happens is that someone reverses the motor and then later doesn't remember (or never knew how) to change the holes the screws go into. Using the correct holes will allow you to advance the timing to the proper point.



The Speed 400 motor with the timing tool in place on both ends.


The rear of the Speed 400 motor and the timing tool.


The Speed 400 motor's timing tool.

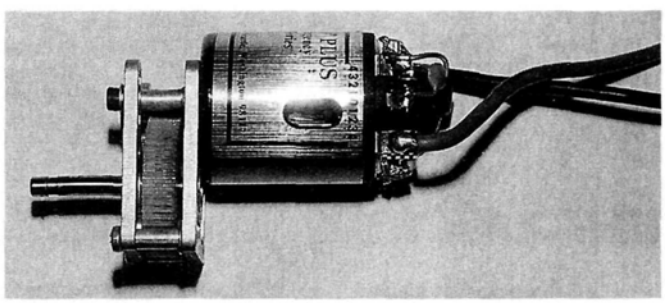
How about the can motors that aren't designed to be adjusted? Some companies make tools that allow you to twist the body of the motor enough to advance the timing. The tool just fits into the existing holes in the Speed 400 motor and is available from many electrics dealers; the ones I use are from Bill Griggs Models* and New Creations R/C*. With the Speed 400-type motors, you can twist just enough to advance the timing without cutting off any locking tabs; on some of the larger can motors, however, you have to bend or cut off the tabs to rotate the body or endbell. When you find the correct setting, use some glue or solder to hold the body in place.

Some of the higher-quality ferrite motors, such as the MEC* Turbo 10+, are adjustable and actually have a label with timing marks. Mine arrived set at zero, and after talking to Pete Peterson at MEC, I decided to set it to the no. 4 mark for the application I had in mind. The label makes it very easy to change timing and go right back to that point at a later date if you change your application. On other motors, I simply use an awl to scratch a tiny reference mark.

There's really nothing to it once you get over the fear of changing the factory setting. I automatically advance the timing of my Speed 400 motors about 5mm from the factory setting because I know I push them more than the applications they're designed for. I don't measure the current for these cheap motors as I would on the more expensive ones, but 5mm seems to be about right for longevity and power and has become a sort of benchmark.

Timing is important, and if it's properly set, it will prevent most of the early performance problems people encounter. Remember, though: *never* use a motor with the timing retarded. This will destroy the motor almost faster than a crash.

That wraps it up for this month; please write and send photos to me at 1016 Camberley Dr., Apex, NC 27502-8107, or email me at greggimlick@mindspring.com so I can share your info with everyone else.


The MEC Turbo 10+ motor with the factory timing marks on its label.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

by Don Edberg

More on PCM versus PPM/FM

SOME OF YOU REMEMBER the opinions I've given on PCM, or Pulse Code Modulation, as a means of controlling R/C aircraft. I continue to get questions and comments about it, so let's discuss it some more.

But first, those who are not familiar with it need to know what it does. PCM is a way to transmit data digitally using ones and zeros (rather than analog, which is usually labeled "FM" or "PPM"). Because it's digital, it requires the R/C receiver to have a computer on board to translate the ones and zeros back into the commanded servo positions. This onboard computer is the main reason why PCM receivers cost more than FM/PPM ones, but it also provides some extra features.

For example, a PCM receiver may be set up so that when it recognizes that the signal coming in is "goofy"— meaning something is wrong, like the signal is absent or there's a lot of interference—it will do something special. The first special thing it might do is Hold, which means that the onboard computer commands the servos to hold the servo positions that were being commanded before the signal had a problem. If it's flying straight and level, the plane continues straight and level; if you happen to be looping your model, the plane continues to loop; if it happens to be diving toward the ground when interference is experienced, the plane will ... continue diving toward the ground.

When your model is diving toward the ground and the interference is steady and continuous, the receiver will just ignore your transmissions, and you won't have any control, which will result in a crash. If the interference is momentary (a glitch) or of short duration and does stop, you may get control back with enough time to stop the plane from hitting the ground ... or you may not.

Another PCM function is called Fail-safe or Preset. For this function to work properly, the operator must define the "preferred" servo positions before flying. When the receiver recognizes a problem, it goes to its memory, recalls the preferred set of positions that the pilot has programmed, and places the servos into those preprogrammed positions. Many pilots choose to program slow, straight, or gently turning flight. For example, you might choose to set throttle at idle, slight up-elevator, slight aileron to left or right.

On some radios, you can individually choose Hold or Preset for each receiver channel! For example, you can order the throttle to move to idle position while keeping the ailerons and elevator where they are.

The Hold function of PCM receivers might cover up other problems on your model. For example, if linkages, pushrods, or other metal parts rub against each other, a type of interference called "electrical noise" is generated. This might occur when a metal clevis is attached to a metal throttle arm, for example. If the noise is generated whenever there's vibration, the PCM receiver might be constantly turning Fail-safe on and off (with Hold function maintaining a constant throttle) during flight, and that would mask this problem by making the chopper appear to fly smoothly. This might be a problem when your model is farther away and the signal strength goes down and there's not enough left to get control back from Fail-safe functions.

Some PCM receivers have Battery Fail-safe; with this function, the

FAIL-SAFE FUNCTIONS

NAME	FUNCTION DESCRIPTION
Hold	When interference is sensed, the receiver commands all servos to stay at the positions they were in just before the interference.
Fail-safe or preset	When interference is sensed, the receiver commands servos to move to previously selected positions (such as low throttle, etc.).
Battery fail-safe	When the battery voltage drops below a safe level, the receiver commands the throttle servo to move to idle to notify the pilot. Pilot may override when added power is needed (but be sure to land soon, because your battery is about to die!)

Note: many radios allow the owner to specify which of the plane's servos will hold the last command and which will move to preset positions.

FAIL-SAFE VERSUS NO FAIL-SAFE: WHICH IS BETTER?

	A model with a PPM/FM receiver will ...	A model with a PCM receiver will ...
When there is interference ...	... "thrash around" in the air, allowing partial control. High or low, you may be able to recover enough to land without major damage.	... "lock out" the pilot. If your model is high, you may have enough time for the interference to end. If it's low, or it's diving when it goes into "hold," too bad.
When the 4-cell airborne battery gets low ...	... do nothing. Unless you monitor your airborne battery, the plane is toast!	... notify you by moving the throttle to idle. Land right away before it dies!
When the 5-cell airborne battery gets low ...	... do nothing. Unless you monitor your airborne battery, the plane is toast!	... not do anything until the voltage drops below the 4-cell safe level, which is too late! Plane will crash.

computer in the receiver keeps track of the airborne battery's voltage. If the voltage drops to a dangerous level, the computer will let you know by automatically moving the throttle servo to the throttle fail-safe position you set, and you are supposed to notice the loss of power and land as soon as possible, before the battery dies. This is usually set for a 4-cell battery pack, so if you fly with a 5-cell pack, this one won't be able to get your attention; by the time it's activated, the 5-cell battery will be dead.

George Steiner's Glitch Recorder provides a scientific way to determine the level of radio interference and other problems experienced by your model.

Remember that FM/PPM receivers cannot perform any of these functions (unless you've added an aftermarket fail-safe unit, such as the "Fail-safe 4U" I mentioned in the December 1997 issue); instead, they try to respond to the interference, making the plane appear to fly around crazily. This can be good or bad, depending on your point of view. My last stated opinion was that I'd rather have a chance at controlling it, but many of you disagree with this, so I asked my friend George Steiner for his opinion. Here's what George had to say:

"Don, as you know, I do a lot of servicing of R/C equipment. I have had the pleasure of having a firsthand look at how well they work using field and lab test equipment for the past 20 years.

"I have found that the PCM radio link will work better in a high noise and interference environment than any other form of communication control. It will reach down and pull out a controlling signal in a way that is just amazing. I see this all the time when I align many R/C systems and test for adjacent channel problems. They have a 3dB better operating range than other forms of modulations for R/C." (Note: 3dB is a *factor of two* in electronic speak.)

George continued, "What is the problem with PCM? Why do so many modelers hold back and use it as a second choice to fly models? One reason is that the modeler fails to recognize when he has an interference problem because PCM covers up many hits until it finally fails ... the modeler never recognizes he is in trouble until it is too late. Had he paid attention to delayed control actions, he could have saved his model. With PPM/FM systems, the effect of interference is instant and visual, with the model going out of control, like a down glitch on landing. I guess the modeler wants to be able to recognize interference rather than fly through it without knowing.

"I fly PCM all the time and pay careful attention to the action of my model. Any delayed action means there could be interference present, and you'd better check on it before it cripples your receiver. This is the reason I developed the Glitch Recorder—to give indications of what is going on in the model.

"The use of a Glitch Recorder will allow you to evaluate your transmit/ receive link for tuning, antenna locations, vibration problems, battery and wiring problems, servo problems and interference. A positive indication will help you to select between a frequency change, a receiver swap and a battery replacement."

The Glitch Recorder may be ordered from G.S.P. Products*; to ensure availability and compatibility with your R/C system, be sure to call before you order. A kit is available for $18; you can also get an assembled, tested version for $76 plus postage.

The choice of receiver depends on what the modeler is looking for—less control and more frequent crashes with "out of control" maneuvers with PPM/FM, or soft control and better range under interference conditions with PCM. In either case, one has to pay attention to what's being used to get the most out of it. Don't condemn one in favor of the other.

George made some brief recommendations on which receiver he recommends for the different classes of models in use: "Sailplanes: PPM will indicate you are out of range, even though PCM would give you more. Helicopters: use PCM as a safety point with no violent maneuvers. Large models: use PCM to keep them on a straight line and not roll in on landing or fly away with the engine running wide open; fail-safe control. Pattern: a toss-up; use PPM or PCM, depending on your personal views. Pylon: PPM is the preferred choice for quick action and close-in flying."

JR's PCM-10X is the new flagship of the line: 10 channels, 10 memories and tons of features. Separate systems are available for aircraft and helicopters—all electronic trims except throttle!

George's final remarks: "It is true that PPM lets you watch your model longer before it hits the ground, but I prefer the PCM rather than having the wings ripped off by some violent maneuver. I understand how it works, and I like the margin it gives."

Another reader took me to task and said that I shouldn't be writing my opinions; instead, I should simply pass on scientific test data. Well, I'd love to do that, but none of the R/C system manufacturers has stepped forward with any test results. If you have or know of any such results, I'd love to publish them.

RADIO CONTROL ELECTRONIC JOURNAL

I own a copy of George Steiner's "A to Z—Radio Control Electronic Journal," and I must say that if you ever had questions about how R/C systems work, what testing the systems reveals, batteries, servos, rubber duck antennas, or how to modify your older systems (for instance, adding channels to a receiver, or adding dual rates), this book is for you! It's not exactly casual reading, but it is a gold mine of information (much more than I could mention here). If you've ever been curious about just what makes your system tick, or if you're an engineer or you like to tinker with your gear, you'll want a copy.

The 131-page book sells for $21 postpaid and is available only from G.S.P. Products.

NEW COMPUTER RADIOS

Two new radios have recently been introduced to the U.S. market: the Airtronics* RD6000 and the JR* PCM-10X. These systems are intended for opposite ends of the R/C spectrum: the RD6000 is a low-cost computer radio, while the PCM-10X is the top of the line for JR radio systems.

Let's look at the RD6000 first. This system has six channels and contains four model memories that may hold any mix of aircraft and helicopters. The standard functions include the usual computer radio features: centering, endpoints, reversing, exponential, dual rates, timers and more. Interestingly, an "advanced" set of menus is a built-in option when the owner has a more sophisticated model to fly: aileron/rudder and flap/elevator mixing, flaperons, V-tails, elevons, differential and two programmable mixers. The built-in heli programming offers the usual pitch and throttle curves, tail-rotor compensation, gyro gain, etc., for regular rotor heads plus four other types of rotor head (CP3F, CP3B, CP4F and CP4B).

Programming is done by using the eight buttons on the front along with the large LCD screen. It may not be apparent, but this new transmitter has "digital trims"—trim tabs that move the neutral position electronically rather than mechanically. Models may be identified with three-character names. You may use the transmitter with all current Airtronics PCM and PPM receivers, and it may be set up for use with other manufacturers' receivers as well. No backup battery is needed, so you never have to worry about losing your memory's contents.

Airtronics' RD6000 is a new entry to the low-cost end of computer R/C systems. It has six channels and four model memories, and airplane and helicopter programming are built in—all electronic trims!

The RD6000 has trainer capability with other RD6000s as well as Infinity 660, Radiant, Quasar, or Vanguard systems with a trainer cord. For safety, a "high-throttle" warning alerts you if you've turned on the radio with the throttle stick in high position. Receivers use the new Z connectors for compatibility with other brands. For more information on this low-price entry to the radio scene, visit your local dealer or call Airtronics.

JR's PCM-10X is at the other end of the spectrum. This is JR's top-of-the-line system with 10 channels and 10 model memories. The airplane version can do practically anything you want for airplanes, and the heli version does it all for helicopters. Like the RD6000, the JR radio has digital trims, but there's one difference: the JR engineers put a regular mechanical trim on the throttle. The trend toward electronic, or digital, trims makes it look as if those of you who dislike them will soon have to learn to live with them!

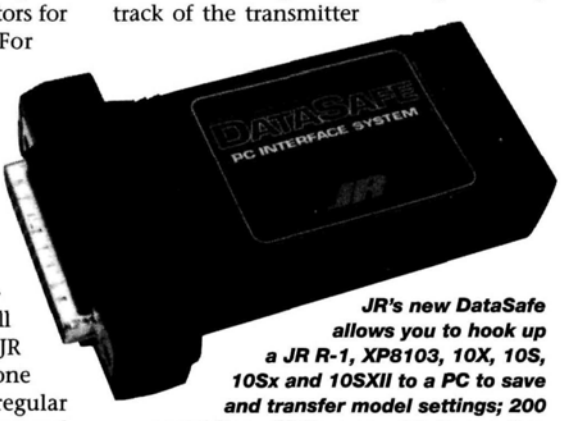
Both versions of the PCM-10X have all of the "normal" computer radio functions as well as up to five different "flight modes" that may be changed by flipping a switch. Furthermore, each mode has its own set of flight trims. Each model memory may be named, and all programming is done with the touch-screen interface; you touch the screen itself rather than buttons near it. The transmitter comes with an 1100mAH battery for up to five hours of operation without needing a charge. Also standard is the new DataSafe personal computer (PC) interface hardware/software (described below) that allows you to store and exchange model setup data files by PC.

Perhaps the only negative aspect of the 10X is that the airplane version doesn't contain helicopter programming and vice versa, so you'll need two transmitters if you own both types of model. In my opinion, this is a pretty significant drawback for a radio system that costs over $1,000 when far less expensive systems do contain both.

DATASAFE

Along with its new radio, JR has introduced its DataSafe—a gadget that allows you to "upload" and "download" model memories between your radio and any PC. The unit is compatible with Windows 95, 98 and NT and works with JR XP8103, 10X, 10S, 10Sx, and 10SxII systems (it's included with 10X systems).

To transfer data, you need a regular trainer cord, the DataSafe and a PC with an available serial port. The computer keeps track of the transmitter type, model number, date and time along with each stored model memory. This makes it easy to send a setup to a friend by email or on a floppy disk. A single HD floppy will hold about 200 model setups!



JR's new DataSafe allows you to hook up a JR R-1, XP8103, 10X, 10S, 10Sx and 10SXII to a PC to save and transfer model settings; 200 model files will fit on one HD floppy disk.

The DataSafe retails for $120 and is available from your local JR dealer and from Horizon Hobby Distributors*. When will other manufacturers match this feature?

Remember, if you want to write to me, send an SASE to Don Edberg, 4922-2 Rochelle Ave., Irvine, CA 92604; or email: <dynamic3@flash.net>; or look for an answer at <http:www.flash.net/~dynamic3/>. I get lots of mail, so please be patient!

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

Coverite Trim Iron

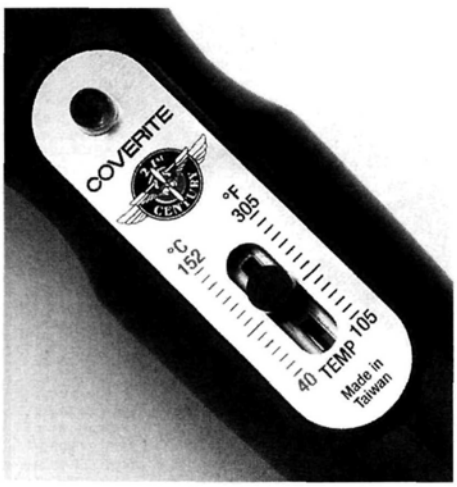
A better tool for covering airplanes

by Larry Marshall

IN FAYE STILLEY'S BOOK "Film Basics and Beyond: Covering R/C Airplanes," he states, "You'll need ... [a] trim iron. Don't let the name fool you. Trim irons are absolutely indispensable for covering, not just trimming." That statement—and his descriptions of how trim irons are used—changed the way in which I used plastic film coverings and improved the appearance of the airplanes I covered using plastic films. Used with a standard-size iron, trim tools are so indispensable that it's hard to understand how you ever got along without one. I own two, and they've had many hours of use.

Not only are they useful for getting into nooks and crannies, for running covering into pushrod exits and for getting crisp edges along fin/elevator interfaces, but a trim iron is also the tool of choice for tacking plastic film into place before you smooth it, sealing hinge lines, general edge-sealing, when pulling covering over wingtips or noses, applying covering over fiberglass parts like wheel pants and—surprise, surprise—applying trim schemes and lettering.

If there's a problem with trim irons, it's that there aren't many to choose from in the marketplace; the Top Flite trim tool is the only one I know, and it runs at only two temperatures. This was OK when the covering world was equally choice-limited, but these days, many heat-applied films are available and each has different glue set and shrink temperatures, causing those of us using trim irons to wish for a good, variable-temperature trim iron to match our standard-size irons.



The temperature control is right on the handle and is easily operated with your thumb.

Well, the wishing has paid off, as the Coverite* folks have just released their variable-temperature trim tool. It comes with a small support stand and two different tips. One is flat on one side and elliptical on the other; the second provides a shallow, curved surface and a flat surface as its working areas, and so far, I've found this one most useful for my personal work style. I like having a flat surface at times, but I found that the flat surface on the compound tip isn't completely free of the mounting bolt (the bolt ends up touching the plastic at times), and so only the very tip of the flat surface is usable, whereas the other tip has its working surface angled relative to the mount point and, thus, its entire surface is available to the user.

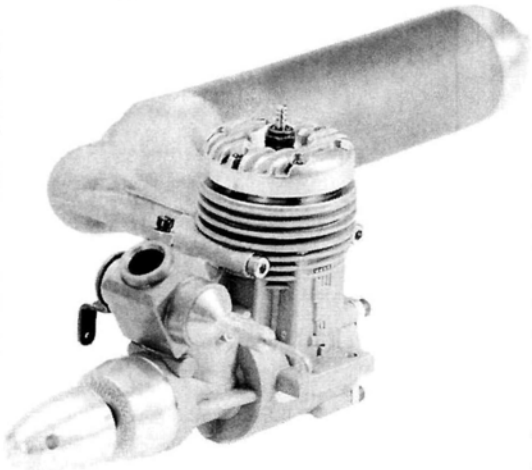
The temperature control is a slide switch located on the handle. Because temperature changes of these small trim heads can occur fairly quickly (standard irons require some time to heat up and cool down), this is really nice, as you can change temperatures while you're working on a piece. The scale says the temperature can be regulated from 105 to 305 degrees Fahrenheit; I attempted to verify these numbers, but the only thermometer I have that reads across this range is my Coverite thermometer, and it's designed to sit on a larger surface than the one provided by a trim iron. About all I'd be willing to say in print is that if you set this thermometer on the flat surface of the compound tip, it will increase and decrease temperature as you operate the iron. Given that Coverite's standard-size 21st Century iron does such a good job of matching head temperature with its control scale, I suspect that the trim iron would be similar, though in my experience, the small heads of trim irons are by nature a bit more variable. Speaking of Coverite's standard iron: it's still one of the finest irons on the market and, though a bit more expensive than some others, it's certainly worth the price. With the introduction of the trim iron, Coverite has assembled the most complete toolkit for the application of plastic films on the market today.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

Sport-Jett .46

I ATTENDED MY first Nationals in 1961 when I was 19 years old. I was awestruck by 1,500 fanatics flying every type of model imaginable from dawn to dusk. Sponsored by the U.S. Navy and held at the Willow Grove, PA, Naval Air Station, the Nats was a dream world that excluded everything but airplanes. We ate, slept, talked and flew models 24 hours a day for an entire week. In retrospect, these Navy Nats provide my most vivid memories in modeling. Although I flew control-line stunt and B-speed that first year, my heart really wasn't in it; I was too busy watching the experts, my heroes from the model magazines, perform their miracles.

One junior contestant performed like a seasoned veteran. In my mind's eye, I can see him struggling to hang on to the controls as the snarling McCoy .60-powered control-line speed model streaked to a winning flight of almost 150mph. Surprisingly, it was only about a decade earlier that the first open-class (adult) flier had attained this feat. Dubby Jett also won A-speed at 133mph with his own airplane design (Zero-G) and an engine that he built himself (Torp .15). Clearly, this 15-year-old Texan was talented!



The Sport-Jett .46 and tuned muffler are a potent package designed with the user in mind. The combination focuses on longevity.

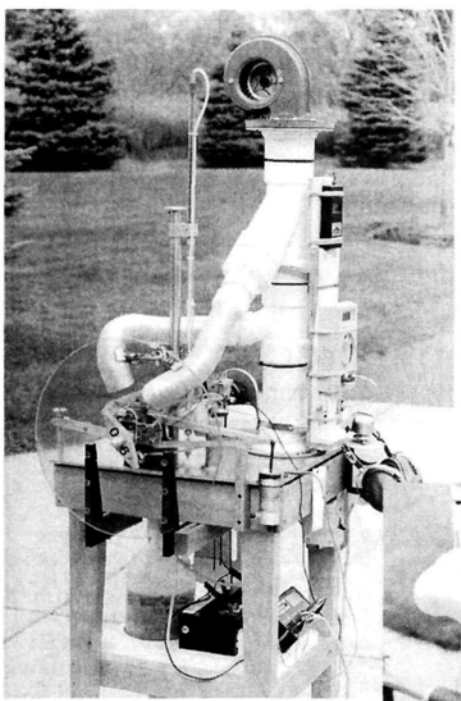
During his formative years, Jett was mentored by several adults, including Phil Bussell and the three Grogan brothers. Although they offered advice and made occasional suggestions, they didn't build his airplanes or prepare his engines; Jett learned by doing it himself.

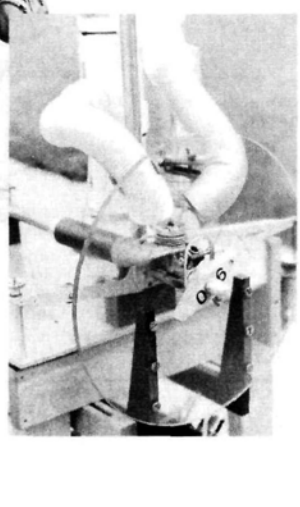
As a senior, Jett won every Nats speed event, including the overall Senior National Championship three years running ('64 through '66). He simultaneously held almost all of the speed records (the exception being jet speed) several times.

During the mid-'70s, Jett manufactured the DJS brand of racing engines with the help of then partner John Shannon. He started flying R/C in 1979 and five years later won the first of three National Miniature Pylon Racing Association national points championships. The team of Jett and Shannon won the World Pylon Racing Championship in 1991. Jett has been the national Formula One, Quarter midget and FAI champion two times each.

After earning a bachelor's degree in aerospace engineering at Texas A&M and a master's in mechanical engineering at the University of Texas, Jett worked for 23 years in the petroleum industry before starting Jett Engineering Inc.* in 1993. Today, his company produces nine sizes of side-exhaust, single-cylinder engines ranging from .36 to 1.2ci displacement and six, rear-exhaust, singles ranging from .40 to .95ci. Jett also offers various racing versions of these as well as .46 and .76 helicopters, a CL stunt .50 and .50 and .95 ducted fans.

Jett Engineering fabricates all but a few components at its facilities on numerically controlled machines; it also does all R&D and design work in house.



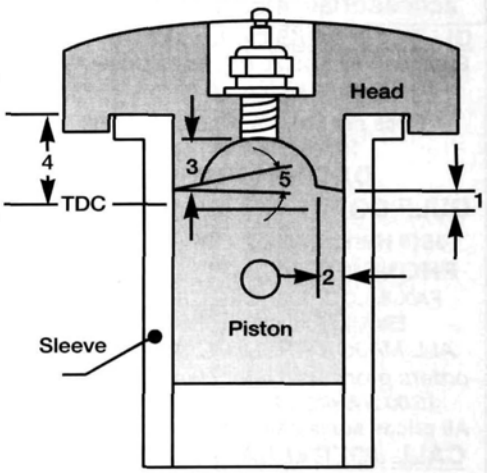


Mounted on the torque-reaction dynamometer, the Sport-Jett .46 is about to reveal its performance secrets. It delivered more b.hp than most .60s tested to date.

SPORT-JETT .46

The .46 was shipped with its tuned muffler and mounting screws, instructions, technical bulletin, price lists, warranty information, carburetor adjustment sheet and decals. It uses front rotary induction, a side exhaust, Schnuerle-type porting, a ball-bearing-supported crankshaft, an ABC piston and sleeve and a fuel-metering-type carburetor.

Head and combustion-chamber dimensions (in.)



1—Head clearance (w/ 0.006 in. head shim)	0.0195
2—Squish band width	0.170
3—Plug depth	0.179
4—Deck clearance	0.1175
5—Squish band angle	0°
Squish band area	63%
Combustion-chamber area	37%

• **Crankcase.** The investment-cast one-piece crankcase has been redesigned. Because a few broke, metal was added to strategic areas, along with a few more fins for improved cooling. Besides its sturdy appearance, the case's most obvious features are the three massive transfer port passageways (bypasses). The case also incorporates large, integral, tuned-muffler

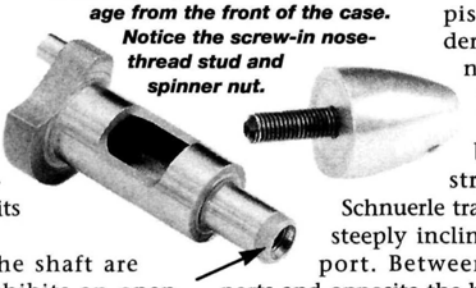
PHOTOS BY DAVE GIERKE

mounting bosses that are intended to withstand severe crash damage. Several prominent manufacturers pay little attention to this critical design feature.

Jett also supplies plated, soft-steel, tuned-muffler mounting screws that are designed to shear off on impact to further enhance engine survivability.

• **Ball bearings**. After some initial trouble with high-priced Japanese ball bearings, Jett achieved satisfactory results with Swiss bearings. His biggest concern with any ball bearing is corrosion. "If I had my choice of after-run oil or being sure the engine is clear of wet fuel, I would take the dry engine ..."; he continues, "As far as I can tell, after-run [oil] is worthless if the engine is put away wet or hung upside-down so that the muffler can drain into the engine. I don't use after-run myself and never have problems, even in Houston." Clearly, the bearing-rust controversy continues.

• **Crankshaft**. The crankshaft is a one-piece steel unit; the crankpin, counterbalance and bearing journal sections are turned from a single billet that has been case-hardened and ground to its final finish.



Notice the spiral machined into the front of the crankshaft (arrowed). It acts like a pump to control fuel leakage from the front of the case. Notice the screw-in nose-thread stud and spinner nut.

Several features of the shaft are noteworthy: first, it exhibits an open crankweb, which speaks volumes about how Jett views the significance of crankcase packing and engine performance. Most contemporary designers have dismissed the notion that efficient delivery of fresh air-fuel mixture from below the piston depends on high primary (base) compression. Much of this responsibility now resides with the tuned exhaust system and its ability to empty the case from the exhaust side of the cylinder.

Second, the shaft's nose threads are formed by a screw-in stud similar to the one on the early K&B Torpedo .40. This feature undoubtedly stems from Jett's desire to build engines that will withstand crashes and suffer only minimum damage. Certainly, it's cheaper to replace a stud than the entire shaft!

Third, a spiral cut in the face of the journal, just in front of the shaft induction hole and behind the front bearing, provides a degree of fuel blow-by control. This Jett-developed "pump" reduces the leakage through the front bearing without resorting to a suction hole. Although this technique works—marginally—a few designers, including Jett, refuse to compromise the performance of the carburetor. Running from behind the front bearing to the venturi (below the carburetor neck), this passageway partially defeats the carburetor's ability to maintain the correct air-fuel mixture, especially during critical idle and transition periods. Jett says, "... I still want the front to blow some fuel. We never blow front bearings—not in years."

The drive washer is clamped to the shaft by the collet-like action of the truncated, split steel cone that locks the shaft to the front bearing's inner race. This limits the rearward motion of the shaft to the amount of end play between the balls and inner race of the bearing—a very worthwhile system, especially when considering the axial loads encountered when an electric starter is jammed onto the engine's spinner!

• **Cylinder**. The Sport-Jett .46 uses ABC (aluminum piston, brass cylinder, chromed) technology that incorporates the following features: brass-chrome construction and twin Schnuerle transfer ports with a steeply inclined boost transfer port. Between the Schnuerle ports and opposite the boost port is a single exhaust orifice. The bore taper from TDC (top dead center) to BDC (bottom dead center) is a moderate 0.0045 inch. The piston forms an interference fit between itself and the cylinder, slightly before TDC, in the traditional manner.

The exhaust port's total open period was measured at 156° of crankshaft rotation. Since the three transfer ports remain open for 128°, this provides an exhaust lead of 14° (156°-128°÷2 = 14°)—ideal for the efficient operation of the tuned exhaust system that's intended to scavenge (clear) the cylinder of exhaust gases before the transfers are opened.

• **Piston, connecting rod and wristpin**. The piston is machined from high-silicon aluminum alloy; the coating appears to have been done by an anodizing process. The free-floating wristpin is retained and centered in the piston by music-wire C-clips in the traditional manner. The steel pin has been blind-bored, hardened and ground to size.

The racing-engine connecting rod is now standard in the Sport-Jett series. Their heavy-duty, aluminum-alloy construction includes bronze bushings at both ends and appropriate oil holes.

• **Throttle carburetor**. In his many R/C engines, Jett has devoted much time and effort to optimizing the action of the fuel-metering carburetor; the results with the .46 are spectacular. How about a reliable

SPECIFICATIONS

Engine: Sport-Jett .46

List price: $225 complete

Cylinder displacement: 0.455ci/7.46cc

Bore: 0.879 in./22.33mm

Stroke: 0.7505 in./19.06mm

Bore/stroke: 1.17:1

Stroke/bore: 0.85:1

Conrod length (center to center): 1.339 in./34.01mm

Conrod/stroke: 1.78:1

Combustion chamber volume @ TDC: 0.65cc

Compression ratio: 12.48:1 (geometric); 8.50:1 (effective)

Carburetor bore: 0.340 in./8.64mm

Crankshaft thread size: 1/4-28

Weight: 12.63 oz./385g (bare); 18.38 oz./521g (w/tuned muffler)

Cylinder taper (TDC to BDC): 0.0045 in.

Maximum torque (oz.-in.): 99 @ 15,850rpm

Maximum b.hp: 1.58 @ 15,850rpm

B.hp/ci: 3.4

B.hp/lb.: 1.37

Oz.-in./ci: 215

Oz.-in./lb.: 86

Tuned muffler: 99dBa @ 15,850rpm

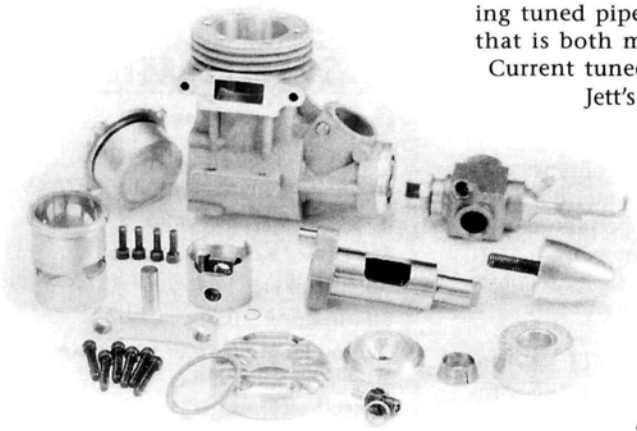
Sound meter: RadioShack no. 33-2050 @ 9 ft.

Features: the Sport-Jett .46 uses front rotary induction, side exhaust, Schnuerle-type porting, ball-bearing-supported crankshaft, ABC piston and sleeve and a fuel metering-type carburetor.

Comments: Dubby Jett sums up his company best: "At the price we charge, we must build the best engine in the world, or it will not sell. 'Best,' however, is in the eyes of the beholder. Our engines are tough, well-made, extremely powerful, start and run well and are attractive. We like to compare ourselves to powerful luxury cars. We don't sell Toyotas; we sell BMWs."

Hits
- User-friendly design.
- Durable.
- Immaculate machine work.
- High performance.
- Best carburetor tested to date.

Misses
- High dBa at performance speeds.



State-of-the-art technology displayed by one of the world's foremost miniature engine manufacturers.

2,300rpm idle with a "whip-crack" transition to full throttle—right out of the box? According to Jett, "... the carb was updated about a year ago. The engine was too rich in the mid range and transitioned too slowly." Through trial and error, he found a cure: "... The curved slot in the carb barrel is tuned for a constant air-fuel mixture throughout the rpm range. The only time that it isn't exactly at the point where the engine wants to come on the pipe ... you must lead the engine with a shot of fuel to avoid having a lean spot [that leads] to burning plugs. At quarter throttle, the engine is leaner, giving it better acceleration from landing and approach wave-offs."

The tuned-barrel groove has a unique round bottom that allows the adjustable plastic stop-screw to precisely remove all of the barrel's axial play (for many commercial carburetors, axial play is a serious detriment to accurate mixture control). According to Jett, the plastic screw exhibits zero wear and allows a very smooth mechanical action that is easily verified by working the throttle arm back and forth a few times—impressive. The downside of using the plastic screw is user damage. Jett explains: "About once or twice a year, someone leaves the stop-screw loose, or shears it off with a wrench [over-tightening] on the 3/8-inch throttle-arm nut." In either case, the barrel flies out of the carburetor housing.

All of the carb parts are honed and lapped; Jett thinks that they're just as important as the piston and cylinder in this regard. The hard-anodized barrel and anodized carb body also exhibit excellent, wear-resistant characteristics.

• **Tuned muffler**. This compact, power-adding muffler technology was developed in the late 1970s in Australia. Known as the "Magic Muffler" system, it figuratively folds a conventional diverging/converging tuned pipe into a compact package that is both manageable and effective. Current tuned-muffler designs such as Jett's function admirably over a wide rpm band (see the power graph) and are user-friendly.

Although relatively high shaft speeds on 2-stroke engines have been blamed for noisy exhausts, recent scientific tests revealed a different culprit. In most cases where an effective silencer is used, the primary source of noise is the propeller. Until there's a breakthrough in propeller design, high-speed rotary prime movers of any type will be noisy; this includes 4-strokes, electrics, compressed air, steam engines and any other power-producing engine or motor.

• **Exhaust extensions**. Nice accessories offered by Jett are the machined, cast-aluminum extensions that fit between the engine exhaust and the tuned muffler. These stackable units are intended to help the modeler to mount the engine/muffler combination on models of varied physical dimensions. Stacks of up to 1/2 inch have little effect on pipe tuning; over 1/2 inch, tuning starts to change. The extensions incorporate a clever male/female locking system that keeps everything aligned. Extension thicknesses are 1/4 and 1/2 inch.

• **Helicopter version**. Jett also sent along the helicopter conversion pieces for the Sport-Jett series. He says, "The only difference between the standard and helicopter [engine] is the cross-over for the exhaust and the larger head. The carb is the same, except that the mid-range/idle needs to be slightly richer—about 1/4 turn—to allow for the higher rpm needed for part-throttle hover. I personally believe that the larger head does little, but people think they need it. I also move the throttle arm 90 degrees."

BREAK-IN

The breaking in of ABC-type engines is a topic I have discussed many times. Here's what Jett has to say: "There are many theories on break-in. ABC and AAC pistons and liners need very little. However, your rod and other moving parts need to be well seated before they can perform reliably. Piped engines and, specifically, piped ABC and AAC engines, tend to work against you during break-in. To adequately loosen up an ABC/AAC, which has some piston/cylinder interference fit, it must be hot. This means running it fast and hard, but this must be done before you break in the rod ... [This is a] problem!

"This is what we do: we run your engine for you and take the first chance. After we start it, we heat it up immediately, but not all the way to peak. We run it rich at about 15,500rpm for about 30 seconds and then start to set the idle. It goes back and forth for about 2 minutes, and then we test the peak rpm. If it runs over 16,000, 16,500 and 17,000rpm for the .40, .46 and .50, respectively, on the 10x6 Master Airscrew and 15-percent fuel, we send it to you."

Jett continues: "Expect your engine to be tighter than you are used to. This is not a problem. The engine will loosen up nicely after a few flights. Engines should be broken in on a slightly smaller propeller than you would usually run. We recommend a 10x5 or a 9x7. This will help you achieve normal operating rpm while still running rich. With the throttle fully open, lean the engine in until it is staged on the pipe and running about 15,500 rpm. If it isn't slightly rich, change to a smaller prop. The Master Airscrew 9x7 should work fine. Let it run there for 15 to 30 minutes. Now, you should be ready to fly."

As an aside, here's what Jett thinks about test stands: "If you call me, the first thing I will ask you is, 'Have you put the engine on a test stand?'... Please don't waste your time and mine until you have done this. This eliminates most of the problems people have. Test stands are cheap and readily available. Get one!" Amen to that.

RPM ON SELECTED PROPELLERS

It was a cool, dry day in November when I ran the Sport-Jett .46 (dry bulb temperature—42° F; wet bulb temperature—37° F; barometer [actual]—29.42 inches Hg). My fuel consisted of 15 percent nitromethane, 10 percent Klotz KL-200, 10 percent castor oil and 65 percent methanol, and the glow plug was a K&B* 1L. The break-in prop was an APC* 9.5x6.5, which performed as advertised.

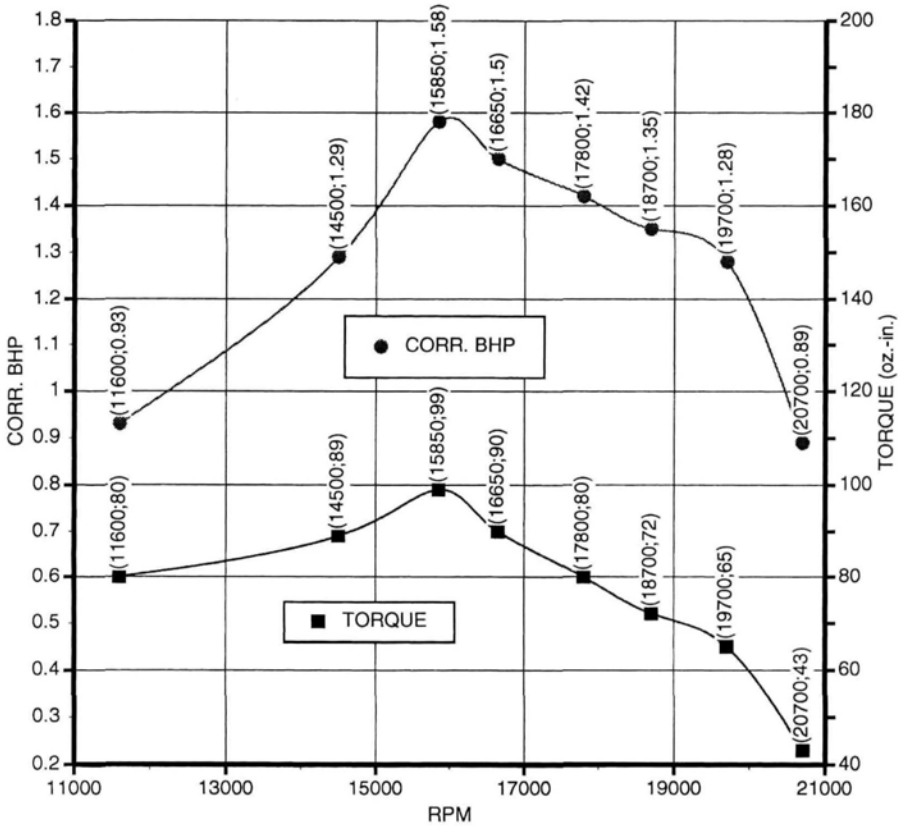
The following APC propellers produced the following rpm:

Prop	Rpm
9x7	17,500
9.5x6.5	17,000
10x6	16,700
9.5x7.5	16,500
10x7	15,300
11x5	15,000
10x8	14,300
12x6	10,500

On the 12x6 propeller, the engine ran hot and erratically, as I expected it would; 10,500rpm at wide open throttle is far below the intended operational minimum for this tuned-muffler-equipped design.

In the letter that accompanies the engine, Jett states: "... I have slowly recognized that the customer needs a little help with prop selection and user-friendliness to get the most out of a Jett. Therefore ... over the years, I have traded the extra power for user-friendliness. The .46 turns about the same peak rpm as it did four years ago, but it has a much better [throttle] mid-range and transition and will pull a bit bigger prop."

RPM	TORQUE	CORR. BHP	BHP	CORR. FACTOR	DISTANCE	Coefficient	54.74
11000						Wet Bulb (F)	37
11600	80	0.93	0.92	1.01	1.464	Dry Bulb (F)	41
14500	89	1.29	1.28	1.01	1.62	Bar Pres (Hg)	29.32
15850	99	1.58	1.56	1.01	1.81	Vap Pres (Hg)	0.25
16650	90	1.50	1.49	1.01	1.638		
17800	80	1.42	1.41	1.01	1.463		
18700	72	1.35	1.34	1.01	1.312		
19700	65	1.28	1.27	1.01	1.19		
20700	43	0.89	0.88	1.01	0.782		
21000							

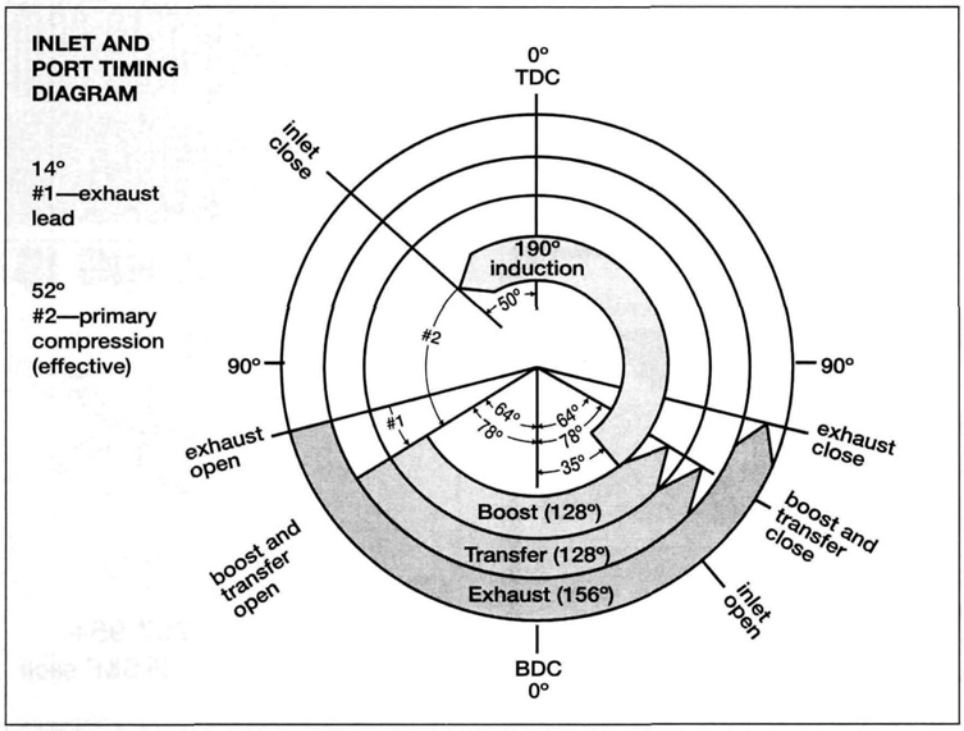


DYNAMOMETER TEST

Look at the torque and corrected brake horsepower graph for a moment. Notice that the torque and b.hp are at their maximum about 15,850rpm; this is where the tuned muffler is at its maximum resonance. At this speed, the engine is producing a healthy 1.58b.hp—more than most .60s tested. Also notice that the pipe remains effective for about the next 4,000rpm before falling off tune. From the graph, we can see that the engine's optimum operating range is between 15,850 and 19,700rpm.

From the group of tested propellers, the top four will certainly be "on the pipe" before the airplane takes off; however, the 9x7 is turning somewhat beyond the recommended rpm for the .46. Depending on the drag characteristics of an airplane and the size (pitch and diameter) and manufacturer of the propeller, rpm can increase; a 2,000rpm increase isn't unusual. In the technical bulletin, Jett writes, "This engine is designed to turn! Don't even think about overloading it with [the] propeller. Peak ground rpm should be about 16,500 to 17,000rpm for the .40 to .50 Sport-Jett engines."

The instructions continue: "Piped engines are much more sensitive to propeller selection than you have been used to. Therefore, the wrong prop can cause many symptoms that lead you to believe that you have other problems. These engines are timed and piped for at least 16,000rpm. If you run a prop that does not turn at least 16,500 at peak, you will not get optimum flight performance and will experience some overheating problems. We have found that typical 10x6 props will turn all the way from 15,000 to 17,000rpm, so a little experimentation is in order."



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ALUMINUM CAN PLANS. Airplanes, racecars, ships, locomotives. LSASE for list. Tesscar, Box 333A, Scappoose, OR 97056, or http://members.aol.com/ tesscar. [12/99]

ESTATE SALE—model plan collection, over 700, A-Z, primarily scale aircraft. $4 list cost is refunded with any order. Ron Noreen, P.O. Box 1554, Auburn, WA 98071. [6/99]

HOT AIR BALLOONS—build 10-foot hot air balloon easily. Plans: $5. Donald Jacobson, 104 Bailey Dr., N. Branford, CT 06471. [10/99]

MINIATURE PLUNGE ROUTER BASE AND NEW TEMPLATE GUIDE BASE. Fits Dremel, Ryobi, Foredom. "Am I impressed? You bet!"—review, *Model Airplane News*, November 1998, p. 78. Bishop Cochran, (503) 231-5694; http://www.bishop-cochran.com. [10/99]

SCALE PLANS by *Vern Clements*, 308 Palo Alto, Caldwell, ID 83605. Send LSASE. [7/99]

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P-47 FIGHTER PILOT OFFICIAL TRAINING MANUAL: 96 pages of pictures and information about all switches, gauges, controls, etc. All you need to know about a P-47. For copy, send $15 U.S. (foreign OK). Jim Matthews, 2324 W. Hammer Ln., Stockton, CA 95209-2327. [6/99]

MINI-BOLT: standard and metric fasteners, drills, taps, dies, ball drivers, hardware. Mail-order catalog—$2. Esseltine Enterprises Ltd., 691 Fife's Bay Rd., Peterborough, Ontario, Canada K9J 6X3; phone/fax (705) 876-8645; email: suee@ptbo.igs.net. [6/99]

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PLANS ENLARGING SOFTWARE—PLANS ENLARGING: old magazines, scanning, plotting. Free information. Concept, Box 669A, Poway, CA 92074; (619) 486-2464. [7/99]

LARGE-SCALE SAILPLANES AND TOW-PLANES—new and used. Call (212) 879-1634; Sailplanes Unlimited, 63 East 82nd St., New York, NY 10028; www.sail planes.com. [8/99]

OBECHI VENEER, premium grade sheets, 1/32"x12"x132" long—$8.50 U.S. +S&H, more sizes available. We manufacture 15 glider kits ranging from hand-launch to 5-meter scale. Hitec dealer. 10-meter rolls of Ultracote. Send $0.60 in postage for our photo-illustrated catalog to Dream Catcher Hobby Inc., P.O. Box 77, Bristol, IN 46507 or see our Web page at http://www.dchobby.com. To order, call (219) 523-1938; we accept Visa/MC. [7/99]

PLANS—R/C sailplanes, scale, sport and electric. Old-timer nostalgia and FF scale and sport-powered, rubber and towline. All models illustrated. Catalog $2. Cirrus Aviation, P.O. Box 7093, Depot 4, Victoria, BC V9B 4Z2 Canada. [8/99]

www.coptercorner.com: a full-service R/C helicopter site since 1978. Email: helifly@best.com. [12/99]

R/C SOARING DIGEST: monthly journal for R/C soaring enthusiasts focusing on technical, construction techniques and glider design since 1984. Sample copy: $2.50. One-year subscription: $30—check payable to RCSD, P.O. Box 2108, Wylie, TX 75098, (972) 442-3910. [6/99]

HIGH-QUALITY LASER-CUT PROFILE AND SCALE KITS. For more information, send SASE to Hoemcraft Aviation, 1204 S. 4th, Independence, OR 97351; website: http://members.aol.com/hoemcraft/aviation.html; email:hoemcraft@aol.com. [6/99]

R/C AUCTION HOUSE—buy and sell your models and accessories online; www.rcauctionhouse.com. [8/99]

1st U.S. R/C FLIGHT SCHOOL. Dedicated, full-time professional R/C flight instruction. Systematic, 5-day, concentrated, hands-on flight courses through solo. Information packet, $3. 86 16th St., Clintonville, WI 54929; (715) 823-2151. [7/99]

BRIDI AIRCRAFT SEMI-RETIREMENT SALE. I have many Bridi kits in stock; good prices. Send SASE for a FREE brochure of remaining aircraft kits in stock to 23625 S. Pineforest Ln., Harbor City, CA 90710; (310) 326-5013 or (310) 549-8264; fax (310) 549-8268. [8/99]

SCALE R/C PROPS—www.terraworld.net/chilcott/. [8/99]

HOBBY SHOP FOR SALE: full-line hobby shop, downtown Grand Junction, CO, in mild-climate Western Colorado. Well established; 7 years. Call (970) 245-5504; ask for Eldon or Jean. [8/99]

PAYING $300 each for the following toy metal outboard motors: Oliver 35, Gale Sovereign 60, Mercury MK- 1000. Want all toy metal outboard motors. Gronowski, 1100 Peninsula Dr., Traverse City, MI 49686; call (616) 941-2111. [8/99]

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SCALE PLANS BY HAROLD OSBORNE—over 175 plans. .049 to 1/3-scale R/C power and sailplanes.1940s C/L Scale, Indoor/Outdoor Rubber Power, Racer and Civilian Scale Drawings. Send no.10 SASE ($0.66) to Ken Kehlet, 6800 St. Mary's Pl., Oklahoma City, OK 73132; email: kbkopyl@juno.com. [11/99]

MARK'S MODEL BUILDING. Custom-built model airplanes. (814) 837-9435; email *marksmdl@penn.com. Visit us on the web:* www.penn.com/marksmdl. [11/99]

MAGAZINE BACK ISSUES: Model Airplane News, Flying Models, RCM, Scale RC Modeler and more. Also: full-scale magazines, 1930s to 1990s. For a list, send SASE to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [11/99]

GAS ENGINES—excellent R/C aircraft and boat power. Homelite, Ryobi, Weedeater, McCulloch, Honda, etc. Conversion kits and accessories information, $5. Visa, M/C. Carr Precision, 6040 N. Cutter Cir., # 303, Portland, OR 97217. (503) 735-9980; fax (503) 285-0553. Website: http://home.att.net/~carrprecision; email: carrprecision@worldnet.att.net. [6/99]

AIRCRAFT DOCUMENTATION—include name of aircraft for availability of documentation with $3 for 3-view and photo catalog. Ian Ross,1447 Helm Ct., Mississauga, Ont., Canada L5J 3G3. [8/99]

DESIGN YOUR OWN AIRFOILS? Now you can! Turn your computer into a virtual wind tunnel with the new Super Numerical Airfoil Creation Kit—"SNACK." Windows 95/98/NT version on CD-ROM with printed manual for only $99.95 + $5 S&H. Write for details or visit www.dreesecode.com for a demo and discounts! DreeseCode Software, P.O. Box 20656, Columbus, OH 43220. [6/99]

WWW.WINDM.COM—build combat aircraft windvanes! Windmodel, P.O. Box 4100, Syracuse, NY 13206-0410. [11/99]

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THUNDER TIGER ARFs and engines for sale: Tiger Trainer .40, $83.50; Tiger Trainer .40 Combo, includes airplane, engine and 4-channel Hitec radio, $274.99; Tiger Sport 40 L, $106.99; Tiger Stick 40, $92.99; Champion 45L, $120.99; Fun Tiger Extra or Giles G-200, $92.99; Windstar 2M Glider, $69.99; Windstar with Hitec 1-stick, 2- channel radio, $129.99; Windstar 2 M Electric Glider, $102.99, with radio $148.99; Raptor .30-size Heli, Pro Model, $414.99; Raptor Regular, $379.99, Raptor kit ,$249.99; TT Pro Heli .36H, $92.75; GP .42, $48.99, Pro .40, $69.99, .46 $69.99, Pro .61 $107.99, FS .54 $145.99, FS .91 $160.99. GCBM R/C MODELS, 5009 Fairdale, Pasadena, TX 77505. Information: (281) 998-2529; orders *only, (800) 609-7951. Visa/MC/checks OK.* [6/00]

HOBBYIST

SAITO FA-300T: brand-new condition; barely broken in—one gallon of fuel only: $650. Randy Bonneau, (972) 529-1300. [8/99]

WANTED: *old, unbuilt plastic model kits* from '50s and '60s. Send list, price to Models, Box 863, Wyandette, MI 48192. [7/99]

MODEL AIRPLANE NEWS, 1930-1980; "Air Trails," 1935-1952, "Young Men," 1952-1956; "American Modeler," 1957-1967; "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C. Canada VOR 101. [10/99]

WANTED: built or partially built scale Cessna 150, 152 or 172. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585; fax (714) 458-6455. [10/99]

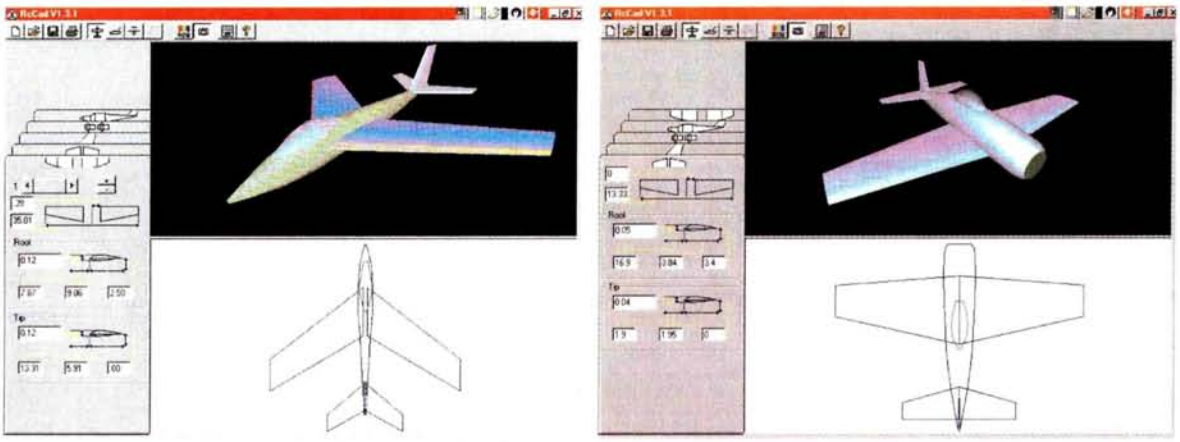
MODEL WARPLANES: 10,000 plans, kits; $18. John Fredriksen, 461 Loring, Salem, MA 01970; http://www.rconline.com/1812. [7/99]

EVENTS

"T.O.C. OF MARYLAND." Fly-in and competition—May 21, 22, 23. Fun-packed weekend filled with fantastic flying and great food! Competitors will fly known and unknown programs with emphasis on freestyle acrobatics. $$ prizes. Raffles. Free flea-market area. Vendors welcome. Call Art Vail, (410) 247-4281, or email artvail@erols.com. [6/99]

BUD'S HOBBY, COUNCIL BLUFFS, IA; 1st ANNUAL LAKE MANAWA "FLOAT FLY," May 16, 1999; registration includes lunch, raffle, prizes, trophies ... and much more! Call for details, (800) 444-6920. [6/99]

Drawing with RcCad



Left: picking up the basics of RcCad takes only a few minutes. I drew this sweptwing electric sport plane in under an hour, learning as I went. The program really lends itself to sketched-out design work like this. The 3D-rendering window lets you see how the finished airframe will look in a way that most low-cost CAD programs can't. Right: scale models can also be drawn in RcCad. This Grumman Bearcat was based on a drawing I had previously created in AutoCAD. The latest version (as of this writing) allows you to import a scanned bitmap as a starting point for a design.

I'VE SPENT the last few evenings trying out a very different approach to using CAD to design model aircraft. This particular application was the topic of some discussion on a list conference for electrics fliers I read regularly, and I was curious enough to download a demonstration copy.

The program is called RcCad, and it operates differently from just about any CAD package that I've tried. Most CAD programs are really pretty similar in operation to working at a drafting table. You use keyboard and mouse commands to draw lines, arcs and other shapes, and these various entities go together to form wings, fuselages, formers and other parts of the airframe. In contrast, RcCad treats each part of the airframe as a solid 3D component that can be edited as you see fit. So to draw a plan view of a wing, you click the wing tab, enter values for the root and tip chord, rake, thickness ratio, etc., and the wing appears in the view window. For you "TLAR" (that looks about right) types, you can drag the span, chord lengths, sweep angles, etc., instead of typing in the values. The same applies to the stab, vertical fin and fuselage. In the fuselage tab, you can add or subtract as many formers as you like, and you can edit the width and height of each former and make the cross-section anything from a sharp-cornered rectangle to perfectly round.

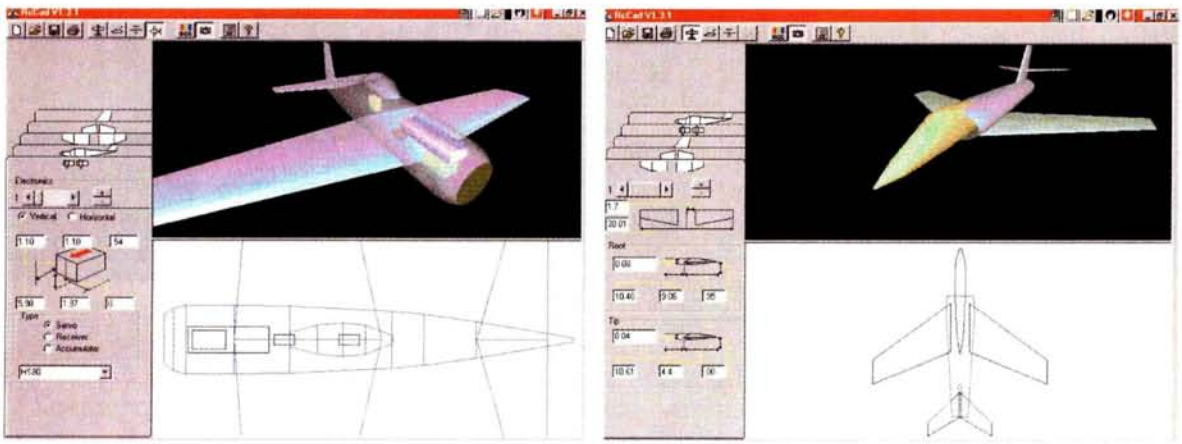
The showcase feature of RcCad is the 3D-rendering window. As you work on the plane in the various view windows, a shaded 3D view of the airframe is constantly updated. You can zoom or rotate this view in any direction to see how the finished aircraft will look from any aspect. I have to admit, this is just plain fascinating, as virtual reality modeling like this usually requires expensive software and a very fast workstation. Yet RcCad did just fine with my plain vanilla Pentium 200.

FROM THE BEGINNING

Starting a new drawing couldn't be easier, as RcCad has a simple, bare-bones airframe that serves as a default template. So instead of generating the wings, fuse and tail group, all you do is edit what's already there. And the editing is really easy; just click each of the tabs and edit the numbers (or drag the entities) until the wing, stab, or whatever suits you.

The fuselage tab is a little different from the others for a few reasons. Obviously, you have to describe a more complex shape to create a fuse, and you can add and shape as many formers as you like to get the desired profile. While you add or edit the formers, the 3D rendering is updated to show you how the finished airframe will look. There's also a smoothing function that will turn your jagged framework into a contoured shape.

The thing you need to keep in



Left: RcCad allows you to position your hardware within the fuselage and check for interference. Each type of hardware (servos, receivers, batteries, etc.) is rendered in a different color. Note that the fuselage is transparent so that you can see the hardware. Right: this sport ducted-fan model was a study to look at ways of fabricating efficient inlet ducting. RcCad's 3D modeling capability is very useful for ducted-fan design.

mind is that to RcCad, "fuselage" is really just a catchall phrase for any 3D solid. Therefore, canopies, intakes, engine nacelles and even wheels are all "fuselages." Simply put, anything that isn't a basic, square-tipped flying surface is a "fuselage." Drawing twin-engine aircraft is a snap because all you have to do is draw one nacelle and then specify the offset distance from the centerline. RcCad knows to move the nacelle to the specified location and mirror it to the other wing.

RcCad can also draw much more complex aircraft. This beautiful de Havilland Comet is the work of UK electrics flier Steve Kerry and is being viewed in Cosmo Player, a Silicon Graphics application that allows you to view VRML files online.

With a little practice, you start to see some very creative uses for the "fuselage" capability. A quick tour of the RcCad website (www.rccad.com) will show you that users have drawn everything from 4-engine flying boats to a Sukhoi 27 fighter and even a battleship!

MAKING USE OF YOUR WORK

After you have drawn the airframe, RcCad also has a tab for installing hardware. There are drop-down lists of commonly available receivers, servos and battery packs, and you can also set up custom components. You can install each piece of hardware in the airframe and then drag it around as you see fit. The real beauty of this capability is that if there's a fit problem, you'll actually be able to see the offending corner of the component protruding through the skin. The interference can be addressed either by dragging the component to a different location or by changing the contour of the fuselage.

After you've completed your design, you have three different options for saving it. You can save the design in RcCad's native .RCD format, in Virtual Reality Modeling Language (VRML) format, or as a .DXF file for importing it into a traditional CAD program for detail work (note that at the time of this writing, the DXF export capability exists only as a beta feature). The DXF export capability is handy, but the current version of the program is only capable of exporting 2D views. This seems a shame for such a nice 3D program, and supporting 3D DXF file generation would be a nice enhancement for future versions.

ASSESSMENT

Every program has its weaknesses, and RcCad is no exception. Because of the simplified nature of the program, you cannot generate formers with irregular shapes (this is being addressed in the new version), and you can't add rounded tips to the wings or tail surfaces (unless you create them as "fuselages"). The program isn't capable of plotting rib stations or generating airfoils.

What this program does do well is to generate VRML more easily than any low-cost CAD package you're likely to find. Where traditional CAD programs take many hours to create a 3D rendering of an airframe, in RcCad, even a novice can accomplish the task in minutes.

So what you end up with is a program that's very useful for roughing out a design, checking for component fit and then looking it over in an easy-to-use 3D environment. But detailed design work like drawing control surfaces, designing the internal wing structure and refining formers to allow for things like skin thickness and stringers will need to be done in a more traditional CAD environment.

At $49.95 for the full-feature registered version, the price is certainly affordable, and it can be purchased online from the company website. So if designing models in 3D appeals to you but has seemed too expensive or complex to master, RcCad is a good place to start.

SCALE **TECHNIQUES**

Continued from page 78

along with a fan unit, pipe and header and remote needle valve—all for about $300. Combine this powerful but inexpensive power system with one of the JHH's kits, and you can get into the air easily for less than $1,000—pretty good deal, if you ask me.

The new Top Flite P-51B razorback Mustang is a completely new design, not a conversion of Top Flite's D-version kit. The 1/5-scale fighter is done right!

TOP FLITE P-51B

I know, I know; the P-51 Mustang is probably the most kitted R/C model in history, and every time a new version is released, it draws much cynicism. I hear comments such as: "What? Another Mustang?" and "What makes this kit so special?" I think you get the picture. Well, if you ask me, the new Top Flite* 1/5-scale P-51B version (a razorback) has been done right! Designed from the start as a "B" version, the new kit is not simply a conversion of Top Flite's already popular D-version kit. Top Flite's usual high-quality die-cutting, hardware packages, decals, plans and instruction booklet make this a great choice for sport-scale and warbird modelers.

Top Flite also offers an impressive injection-molded-plastic, 4-blade static propeller and a 1/5-scale pilot figure for the Mustang.

INVISIBLE GLOVES

Whenever you use fillers, paints, or solvents, it is a good idea to protect your hands. Available from F&M Enterprises*, Invisible Gloves forms a thin layer on your hands and prevents chemicals from being absorbed by your skin. It comes in a small tub container, and you use it like hand cream: just scoop out a small amount with your fingers and rub it all over your hands and wrists. I like the stuff because my hands don't feel greasy when it has been completely rubbed in. Give Chip Mull at F&M a call and try some.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

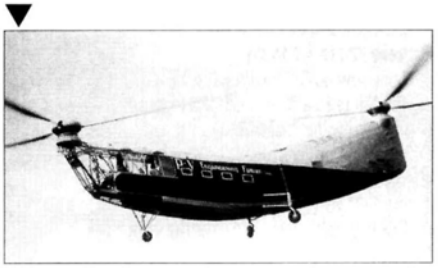
NAME THAT PLANE

Can you identify this aircraft?

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.

The winner will be chosen four weeks following publication from correct answers received (delivered by U.S. mail) and will receive a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free, one-year extension of his subscription.

Congratulations to Jim Love of Monroe, CT, for correctly identifying the March '99 mystery plane, which was nicknamed the "Flying Banana." The Piasecki PV-3 Rescuer was a large, tandem-rotor helicopter designed for air/sea rescue work in the U.S. Navy, Coast Guard and Marine Corps, and the prototype XHRP-1 seen in the photo first flew in March 1945. Power was provided by a 600hp Pratt & Whitney Wasp engine, and the helicopter could hold two pilots, eight passengers, six stretchers and rescue equipment or freight. Its maximum speed was 167mph.



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3 Sea Bees, P.O. Box 747, Lake Stevens, WA 98258; (425) 334-6089; fax (425) 397-2126.

Air Magic Mfg., 3200 Dutton Ave., #116, Santa Rosa, CA 95407; (707) 542-5721.

Airtronics, 1185 Stanford Ct., Anaheim, CA 92805; (714) 978-1895; fax (714) 978-1540.

APC Props; distributed by Landing Products (address below).

AstroFlight Inc., 13311 Beach Ave., Marina del Rey, CA 90292; (310) 821-6242; fax (310) 822-6637; website: www.astroflight.com.

Aveox Electric Flight Systems, 31324 Via Colinas, #103, Westlake Village, CA 91362; (818) 597-8915; fax (818) 597-0617.

Bill Griggs Models, 3137 Whitelaw Rd., Canastota, NY 13032; (315) 697–8152; website: www.aiusa.com/bgriggs.

Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651; (773) 626-9550; fax (773) 626-9566.

Castle Creations, 1625 E. Drury Ln., Olathe, KS 66062; (913) 397-0813; email: pdelcast@idir.net.

Cermark Electronics, 107 Edward Ave., Fullerton, CA 92833; (714) 680-5888; fax (714) 680-5880.

Cirrus Ventures; distributed by Global Hobby Distributors (address below).

Coverite; distributed by Great Planes (address below).

Cox Hobbies, 350 W. Rincon St., Corona, CA 91720; (909) 278-7282.

Du-Bro Products, P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (847) 526-1604; website: www.dubro.com.

Expert; distributed by Horizon Hobby Distributors (address below).

F&M Enterprises, 22522 Auburn Dr., El Toro, CA 92630; (714) 583-1455; fax (714) 583-1455.

FMA Direct, 9607 Dr. Perry Rd., Unit 109, Ijamsville, MD 21754; (800) 343-2934; fax (301) 831-8987; website: www .fmadi rect.com.

Futaba Corp. of America, P.O. Box 19767, Irvine, CA 92723-9767; (949) 455-9888; fax (949) 455-9899.

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; website: www.greatplanes.com.

G.S.P. Products, c/o George Steiner, 2238 Rogue River Dr., Sacramento, CA 95826; (916) 362-1962.

Hangar 9; distributed by Horizon Hobby Distributors (address below).

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Innovative Products, P.O. Box 4365, Margate, FL 33063.

Jett Engineering Inc., 6110 "J" Milwee St., Houston, TX 77092; (713) 680-8113; fax (713) 680-8164.

Jet Hangar Hobbies, P.O. Box 1607, Hawaiian Gardens, CA 90716; (562) 467-0260; fax (562) 467-0261.

JR, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511; website: www .horizonhobby.com.

K&B Mfg. Inc., 2100 College Dr., Lake Havasu City, AZ 86403; (520) 453-3030; fax (520) 453-3559.

Landing Products, 122 Harter Ave., Woodland, CA 95776; (916) 661-0399.

Loctite, 18731 Cranwood Ct., Cleveland, OH 44128; (216) 475-3600.

Maxx; distributed by Cermark Electronics (address above).

McDaniel R/C Inc., 1654 Crofton Blvd., Ste. 4, Crofton, MD 21114; (410) 721-6303; (301) 721-6306.

MEC, 14550 20th Ave. N.E., Seattle, WA 98155; (206) 440-5772.

MFA; distributed by Hobby Lobby (address above).

Modelair-Tech, P.O. Box 1467, Lake Grove, NY 11755-0898; (516) 981-0372.

MonoKote; distributed by Great Planes (address above).

MRC (Model Rectifier Corp.), 80 Newfield Ave., Edison, NJ 08818-6312; (732) 225-6360; fax (732) 225-0091; website: www .modelrec.com.

New Creations R/C, P.O. Box 496, County Line Rd., Willis, TX 77378; phone/fax (409) 856-4630.; website: www .newcreations-rc.com.

Norvel, 2244 E. Enterprise Pky., Twinsburg, OH 44087; (800) 665-9575; fax (330) 425-3935; website: www.norvel.com.

O.S.; distributed by Great Planes (address above); website: www.osengines.com.

Pacer Technology, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730; (909) 987-0550; (800) 538-3091.

PFM; distributed by Innovative Products (address above).

Pica Inc., 2655 N.E. 188th St., Miami, FL 33180.

Prather Products, 1660 Ravenna Ave., Wilmington, CA 90744-1398; (310) 835-4764.

Proctor Enterprises, 25450 N.E. Eilers Rd., Aurora, OR 97002; (503) 678-1300; fax (503) 678-1342.

Reid's Quality Model Products, 30 Clifton St., Phelps, NY 14532; (315) 548-3779.

Robart Mfg., P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174; (630) 584-7616; fax (630) 584-3712; website: www.robart.com.

Romco Mfg., P.O. Box 836, South Houston, TX 77587; (713) 943-1867; fax (713) 943-7630.

Sig Mfg. Co. Inc., P.O. Box 520, Montezuma, IA 50171; (800) 247-5008; (515) 623-5154; fax (515) 623-3922; website: www.sigmfg.com.

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Top Flite; distributed by Great Planes (address above).

Tru-Turn; distributed by Romco Mfg. (address above).

Williams Bros., 181 Pawnee St., San Marcos, CA 92069.

MODEL AIRPLANE NEWS (ISSN 0026-7295, USPS 533-470) is published monthly by Air Age Inc., 100 East Ridge, Ridgefield, CT 06877-4606 USA. Periodical postage permit paid at Ridgefield, CT, and additional mailing offices.

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BY GUY FAWCETT

A scale Halberstadt

DO YOU LIKE SCALE but are unable to transport large airplanes? Have you ever considered Speed 400 scale? I've built just about every kind of model, including large-scale R/C planes with which I've competed in the Scale Masters, but I'm having a love affair with the challenge of building scale aircraft that are powered by Speed 400 electric motors. It seems these planes are like peanuts; you can't stop at just one, but indulging in this addiction is inexpensive—both in time and materials.

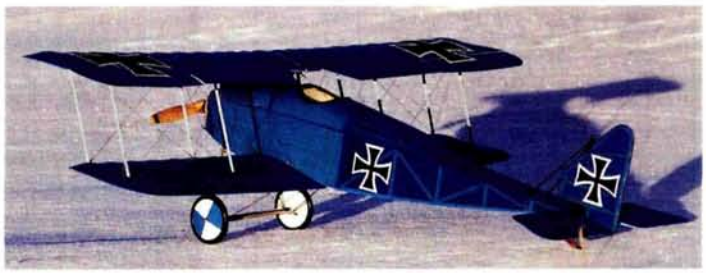
My favorite era is WW I, and my latest effort is a scale model of a Halberstadt DII, a German double-bay biplane from 1916. Built to a scale of 1:9.6 (or 1.25 inches to the foot), the model has a wingspan of 36 inches and weighs 21 ounces, giving it a wing loading of a little more than 8 ounces per square foot. Power is provided by a 6V Speed 400 using eight Sanyo 600AE cells. The motor drives a 9x6-inch prop through an MFA* Mini-Olympus 2.33:1 gear drive. The radio system is comprised of a Hitec* 555 receiver providing signals to two Cirrus* CS-21s, one Futaba* micro and a Castle Creations* Sprite-20 controller.

To produce a light and strong biplane structure, fully functional flying wires and pull/pull control systems are a necessity. Did I hear someone out there moaning? Yes; my 36-inch biplane is equipped with pull/pull systems to control the full flying horizontal and vertical stabilizers and the ailerons. The secret ingredient that makes this possible is braided Spectre line, sold in fishing tackle shops under the trade name "Spiderwire." Spectre is high-tech material akin to Kevlar; it's extremely light and strong and, unlike many other fishing lines, it does not stretch and is temperature-stable. Spectre has another important feature that is both an advantage and a problem: it is extremely slippery. It can be run around 90-degree turns with a simple turnaround; I use the eye cut from a fishing hook, and it works quite well. The drawback to the lack of friction is that knots have to be tripled, or even quadrupled, then glued with CA before they can be trusted not to unravel.

To reduce structural weight, the rigging was made functional. By using ¼x⅛-inch balsa spars with ¼-inch-square spruce reinforcements only at each interplane strut entry point, the wings are extremely light and flexible. The spruce interplane struts have short lengths of 1/32-inch music wire at each end that slip into 1/16-inch aluminum tubes in the spruce reinforcements. The struts are only there to keep the wings apart while the landing and flying wires attempt to pull them together, thereby eliminating any complex attachment fitting. Flying wires are tied to fishhook eyes at the base of the struts. The wings are also designed to be removed. Generally, this is not done, but in case of damage it would be possible to replace a wing panel, and it allows me to break the airplane down for long journeys.

The pull/pull systems for the elevator and rudder follow the same basic pattern. The horn itself is made from 1/16-inch ply, and each attachment hole is reinforced with a 1/16-inch aluminum tube. Spiderwire is knotted through the hole at one end of the horn, then threaded through the fuselage to the appropriate servo and put through the arm on one side. After looping around the servo-arm retaining screw, the line is pulled out the opposite arm through a hole equal distance from the center. From here, the line runs back down the fuselage to the opposite side of the horn from whence it started. Now it is a simple matter to knot the attachment and tighten the slack out of the Spiderwire. To center the control surface, simply back off the servo-arm retaining screw and allow the closed loop to slide as the surface is moved by hand into position, then simply tighten the screw.

The closed-loop aileron system mimics the full-size practice. Each aileron has a 2-inch length of carbon-fiber rod centered on the leading edge of the movable surface. The portion of the rod ahead of the aileron runs in an open box through the wing surface. A control wire runs from the front of the rod down to the lower wing and around a fishhook eye. Then, using a drinking straw as a guide tube, the line travels the length of the wing panel and attaches to a connector in the fuselage made of fishing tackle swivels. From here, it duplicates the path in the opposing panel and ends up at the front of the rod on the opposite aileron. A second wire runs from the opposite end of the rod (about the center of the aileron) on each wing and parallels the first wire until it reaches a centrally mounted servo in the lower fuselage. The two loose ends from each panel are threaded through the same hole on the servo arm and taken round the servo-arm retaining screw that is then tightened when the ailerons are physically centered.



PHOTOS BY GUY FAWCETT

The result is an aircraft that is lightweight and functional. Trust the original designers on these old birds and don't try to build cantilevered wings on an aircraft originally designed for external bracing; it only leads to building over-thick wings with heavier materials.

Addresses are listed alphabetically in the Index of Manufacturers on page 134.